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CTENOPTERIS IN AMERICA

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SIXTEEN PLATES

Epiphytes, small or of moderate size; rhizome short-creeping or erect, rarely elongate, dictyostelic, densely paleate, entire or ciliate or even setulose on the surface; stipes congested, non-articulate or less commonly articulate to the rhizome; fronds usually lanceolate, contracted to both ends, typically pectinate (whence the name) whether pinnatisect or pinnate, rarely more compound, herbaceous to fleshy or coriaceous, setose or glabrescent but not paleate, veins plural or many in each segment, almost always simple, sori dorsal or terminal on the veins, round or elliptic, superficial to deeply immersed, without paraphyses, sporangia rarely setulose, pedicel of one row of cells except near the top, annulus of 8 to 14 (usually 12) cells, spores globose-tetrahedral, without epispore.—Genera *Filicum*.

I have called the choice of *Ctenopteris* as the generic name of these ferns a "border-line" case. Blume coined the name in 1829, misdated as 1828, listed several species, of which the first was *Ctenopteris celebicum*, and said that it was a good genus, but did not properly publish it. Kunze, Bot. Zeit. 4 (1846) 125, treated it as published by Blume, with *Ctenopteris venulosa* as a type species, but again did not properly publish it. Newman, Phytologist 4 (1851) App. XXVIII, used the name *Ctenopteris* for *Polypodium vulgare*, without any effect except perhaps to invalidate it for any other use.

Fée, perhaps in 1842 and certainly in 1852, introduced another name, *Cryptosorus*, typified by *Cryptosorus Dionaea*, which is Kunze's type, *Ctenopteris venulosa*. *Cryptosorus* is a

possible valid name for the genus. There is still another valid name, *Prosaptia*, Presl, Tent. (1836), which shades almost insensibly into the common type of *Ctenopteris* and *Cryptosorus*.

Aside from *Polypodium*, the oldest generic name ever applied to any of these ferns is *Grammitis*, Swartz (1801, 1806). *Grammitis* and *Ctenopteris* have a common element, and Ching has combined them. Both are large genera, and I do not find their combination convenient.

Next in age is *Xiphopteris*, Kaulfuss (1820, 1822). It is not sharply distinct, and Maxon does not regard it as a distinct genus.

All of the foregoing genera being in doubt at least as to their boundaries, action by a congress may be required for a decision among them. My preference is *Ctenopteris*; and no confusion will result from my using it.

The numerous species fall into more or less distinct groups. I. The group of *Ctenopteris moniliformis*. This group has some affinity for *Xiphopteris*.

Groups 2 to 7. These are typical *Ctenopteris*.

Group 8. A single species, of doubtful affinity.

Groups 9 to 10, with forked veins.

GROUP OF CTENOPTERIS MONILIFORMIS

(Small, linear coriaceous ferns)

Key to the species

Fronde glabrous or short-setulose.

Paleæ entire.

Pinnæ broad and short.

Fronde typically 15 cm long 1. *C. moniliformis*

Fronde typically 30 cm long.

Segments broadly rounded 5. *C. assurgens*

Segments acute 6. *C. Rosarum*

Pinnæ over half longer than wide.

Brownish beneath.

Rigidly coriaceous 2. *C. peruviana*

Subcoriaceous.

Fronde over 10 cm long 3. *C. melanosticta*

Fronde under 10 cm long *C. anfractuosa*

Pale beneath 4. *C. calva*

Pinnæ over twice as long as wide.

Segments rounded or obtuse.

Fronde narrowly linear.

Sori superficial 7. *C. rigescens*

Sori impressed 8. *C. jubaeformis*

Frond broadly linear.

Sori dorsal on veins 9. *C. pseudonutans*

Sori terminal on veins.

Frond acuminate 10. *C. pilosissima*

Frond caudata 11. *C. megaloura*

Segments somewhat acute.

Rhizome long-creeping 12. *C. Sodiroi*

Rhizome short-creeping 13. *C. subcapillaris*

Paleæ ciliate.

Fronds glabrous.

Sori single on pinnæ 14. *C. militaris*

Sori commonly two pairs 15. *C. humilis*

Sori more numerous.

Fronds mostly pinnatifid.

Veins up to 4 pairs 16. *C. Tamandarei*

Veins about 7 pairs 17. *C. Tunguragua*

Fronds mostly pinnate.

Pinnæ flat 18. *C. ciliolopsis*

Sides of pinnæ reflexed..... 19. *C. allosuroides*

Rachis and costæ setiferous 20. *C. cuencana*

Fronds conspicuously setose.

Frond broadly linear 21. *C. Pennellii*

Frond narrowly linear 22. *C. congesta*

1. CTENOPTERIS MONILIFORMIS (Lagasca: Swartz) J. Smith.

Ctenopteris moniliformis (Lagasca: Swartz) J. SMITH, Hist. Fil. (1875) 184.

Polypodium moniliforme LAGASCA apud SWARTZ, Syn. Fil. (1806) 33; SCHKUHR, Kryft. Sew. 188, Plate 8c.

Polypodium subcrenatum HOOKER, Icones Pl. (1845) 719.

Jamesonia adnata KUNZE, Farnkr. II (1851) 80, Plate 133.

Polypodium angustissimum FÉE, Crypt. Vasc. Bras. II (1872-73) 55, Plate 96, fig. 3.

"P. moniliforme, frondibus pinnatifidis, laciniis semirotundis convexis glabris, fronde lineari."—Lagasca, l.c.

"Peruvia."—Swartz, l. c.

Fronds pinnatifid, linear; segments half-round, convex, glabrous. The term "convex" describes the condition more often expressed by "coriaceous." Plants conforming to this diagnosis and matching Schkuhr's figure are fairly common in Peru at altitudes of about 3,000 m. Examples are *Osgood* 71, 85, *Bues* 1804, *Killip & Smith* 23887, *Bryan* 549 B.

The description of these typical plants can be amplified: Rhizome short-creeping, immersed in entire; acuminate, castaneous paleæ 4 mm long by 1 mm broad; stipes filiform, 2 to 5 cm long, more or less setose but glabrescent; lamina 10 to

15 cm long, 7 to 9 mm broad, pinnate in the lower part with completely adnate pinnæ, pinnatifid upward, the pinnæ or segments well described as half-round; the sori in full fruit usually 4 (as specified by Schkuhr) but sometimes 5 or 6 to the segment, marked by depressions on the upper surface, the lower 2 usually oblong instead of round, annulus of 12 to 14 thickened cells.

The fronds are sometimes more narrowly linear,—Killip & Smith 24409, 24845.

Typically, the segments are about as wide as long, but not rarely they are longer,—up to a half longer than wide.

Usually at major altitudes, dwarf forms occur, with congested fronds 3 to 5 cm long and paleæ 2 mm long. These look distinct, but I construe them as edaphic modifications. Examples are Macbride & Featherstone 1768, Killip & Smith 23295, Soukup 1915, Goodspeed 10008.

The rhizome are various, sometimes short and almost erect, Sometimes little or much elongate, and stout or slender.

Ctenopteris moniliformis is common in Bolivia, represented by all variants known in Peru. Forms with narrowly linear fronds are most common in Bolivia,—William 1664 is a good example.

Brazilian specimens are mostly from Itatiaya, near Rio Janeiro, and almost all are of the narrowly linear form described here as *P. angustissimum*, typified by Glaziou 5297. Examples are Rose & Russell 21280, 21283, 21285, 21286, 21493, Brade 6468, Dusen 156, L. B. Smith 1872 partim, Mexia 4061, Luetzelburg 68826, Ule 675.

Polypodium subdicarpon Fée, Crypt. Vasc. Bras. II (1873) 55. Plate 96, fig. 4, was described from the same region, and was also reduced to *Polypodium moniliforme* by Christ, Bull. Boiss. II 2 (1902) 362. This was probably correct; but Fée's description and figure suggest that his specimen was probably immature.

All forms known in Peru occur also in Ecuador, the narrow form predominating. *Polypodium subcrenatum* Hooker, described from Quito, is perfectly typical *Ctenopteris moniliformis*, and was so reduced by Hooker, Sp. Fil. IV 182. following Mettenius, Pol. (1856) 41.

Ctenopteris moniliformis must be very common in Colombia, as the U. S. Nat. Herb. contains some three dozen collections. On the whole, these are narrow forms, one of which was described as *Jamesonia adnata*.

Polypodium moniliforme var. *bogotensis* Hieron., Hedw. 48 (1909) 249, is a broader form with elongate rhizome and paleæ up to 8 mm long and $2\frac{1}{4}$ mm wide. The sori may be as many as 5 to 6 pairs on a pinna. It might be regarded as a distinct species.

Specimens from Venezuela, Panama, Central America and Jamaica are usually small, rarely even dwarfed. Christ gave a varietal name *minus* to a Costa Rica collection, with which he identified one from Brazil; the term will better be regarded as merely descriptive. The few collections from Haiti are of typical size or somewhat larger. In Mexico, the species ranges north to the Federal District, and is uniformly typical or slightly smaller.

2. CTENOPTERIS PERUVIANA (Desvaux) J. Smith.

Ctenopteris peruviana (Desvaux) J. SMITH, Hist. Fil. (1875) 184.

Polypodium peruvianum DESVAUX, Prod. (1827) 231; HOOKER & GREV., Icones Fil. 223; HOOKER, Sp. Fil. IV 186; ETTINGSHAUSEN, Farnkr. d. Jetztwelt 32, Plate 19, fig. 7, Plate 21, fig. 11; HIERONYMUS, Bot. Jahrb. 34: 506

Rhizome usually short-creeping or ascending, stout for so small a plant, paleæ 3 to 4 mm long, lanceolate, fuscous, entire; stipes 1 to 3 cm long, 0.7 mm thick, pubescent with hairs 1 mm long, glabrescent; lamina commonly 5 cm long by 6 mm wide, pinnate, dark, singularly rigid for so small a plant, axes glabrescent, segments half-longer than wide, obtuse; sori 1 to 4 on each segment.

PERU, Spruce 4642 (cited by Hooker, Sp. Fil. IV 182 as *P. moniliforme* var. *rigescens*), Macbride & Featherston 1110, Bues 990, 1022, Pennell 13736; BOLIVIA, Williams 1163, Steinback 9859, Asplund 4843; ECUADOR, Lehmann 5006 (cited by Hieronymus), Little & Paredes 6824; BRAZIL, Brade 6469; Argentina, Hieronymus s. n., Venturi 3016, 4675, Jorgensen 1919, Lorentz 786.

Christ, Bull. Boiss. II 2 (1902) 369, reduced both *Ctenopteris peruviana* and *Ctenopteris rigescens* to *Polypodium moniliforme*, but I can not follow him. The species most similar to *Ctenopteris peruviana* is *Ctenopteris melanosticta*.

3. CTENOPTERIS MELANOSTICTA (Kunze) Copeland, comb. nov.

Polypodium melanostictum KUNZE, Linnaea 9 (1834) 44; METTENIUS, Pol. 12; HIERONYMUS, Bot. Jahrb. 24: 503.

"Fronde lineari, acuminata, subsessili, glabra, laciniis untrinque decrescentibus, oblongis, integerrimis, coriaceis, subtus punctulatis, supra apicibus venularum submarginalibus, incrassatis, nigro-notatis; soris uniseriatis, demum confluentibus."

Type collected by Poeppig in Peru, "rupibus aridis ad Cuesta de Carpis." Peruvian specimens 2 or 3 inches long. A Brazilian specimen, 1. *Beyrich*, was regarded as the same species.

Confidently referable to this species are *Lehmann* 7382 from Colombia, so cited by Hieronymus; *Bues* 1574 from Peru; *Williams* 1162 from Bolivia; less confidently, *Damasio* 18368 from Minas Geraes, Brazil, identified by Christ.

I refer here also the following collections which Maxon, in the herbarium, identified as his *P. calvum*: (*Tuerckheim*) *Donnell-Smith* 53, *Cook & Griggs* 399, *Johnson* 374, 887, 930, *Goll* 204, *Hatch & Wilson* 93, all from Guatemala; *Standley* 34990, 43810, from Costa Rica; *Ekman* H 12730, from the Dominican Republic.

Kunze emphasized the hydathodes over the vein-tips as the most distinctive character of *Polypodium melanostictum*; but these really characterize the whole group of *Ctenopteris moniliformis*. Mettenius wrote: (*P. melanostictum*) "differt a *P. moniliforme* foliis brevissime petiolatis, magis herbaceis, quam coriaceis, laminis longioribus, angustioribus, nervis non immersis, sed, laciniis humectatis, manifestis."

4. CTENOPTERIS CALVA (Maxon) Copeland, comb. nov.

Polypodium calvum MAXON, Jour. Wash. Acad. Sci. 12 (1922) 440.

Maxon's very detailed description of *Polypodium calvum* includes no mention of *Polypodium melanostictum*, and does not conflict with the descriptions of that species. So far as descriptions are concerned, *Polypodium calvum* should be reduced. However, when types or authentic specimens are compared, one difference is apparent:—the nether surface of the lamina of *Polypodium calvum* is conspicuously pale, not brown. Specimens of *Polypodium calvum* are:

CUBA, *Leon* 11131, (type) *Wright* 1050, *Clement* 1008, 1403, 1732, 1735, *Leon*, *Clement & Roca* 10504, *Hierom & Clement* 6480, *Hierom* 7011, 7029, *Ekman* 5213, 7085, *Morton & Acuna* 3198, 3509, 3542, 3544, 3554, 3571, all from Eastern Cuba.

The conspicuous uniformity of this wealth of material seems to justify the recognition of *Ctenopteris calva* as a local species.

5. CTENOPTERIS ASSURGENS (Maxon) Copeland, comb. nov.

Polypodium assurgens MAXON, Cont. Gray Herb. 165: 73.

Rhizome elongate, ascending, 3 to 5 mm thick. paleæ lanceolate, brownish, 4 to 5 mm long; stipe 1 to 5 cm long, 1 mm

thick, glabrate; lamina erect, 25 to 30 cm long, 7 to 12 mm wide, pinnatisect or pinnate; rachis fuscous, at first minutely puberulous; segments 50 to 70 pairs, subquadrate or rounded-deltoid, the lowest alariform, middle ones 3 to 6 mm long, 4 to 6 or 7 mm wide at base; sori 2 or 3 pairs.

Haught 3226 (type) from Ecuador, Quito to Santo Domingo road, alt. 2,300 m, "in a bed of moss"; also, *Bues A 27*, from Cerro Chuyapi, Cuzco, Peru. Here belong *Bues A 33* and *1964*, and *C. Vargas C. 2216*, all from Cuzco; also, I believe, *Pennell 10548, 10353*, from Colombia, Cerro Tatama, alt. 3,400 to 3,700 m; their rhizome is ascending or subhorizontal, and the segments of some fronds are up to 7 mm long by 3.5 mm broad, and correspondingly with up to 5 pairs of sori; other fronds have shorter segments and fewer sori.

This is a glorified *Ctenopteris moniliformis*, distinct enough to merit specific status.

6. *CTENOPTERIS ROSARUM* Copeland, sp. nov.

Plate 1.

C. gregis C. Moniliformis rhizomate repente, breve, 1.5 mm crasso, paleis nigris 1-1.5 mm longis, ovatis integris vestito; stipitibus confertis, 1-2 cm longis, brunneis, setosis tum demum glabrescentibus; lamina 30-40 cm longa, 12 mm lata, utrinque longe attenuata, vix pinnata, rhachi nigra superne setulosa; segmentis triangularibus, acutis, ca. 7 mm longis, basi 6 mm latis, anguste confluentibus, rigide coriaceis, brunneo-viridibus, inferne minute et sparse setosis, lateribus deflexis; venis simplicibus, occultis; soris medialibus, utroque latere costae 3 vel 4, sporangiis nudis.

ECUADOR, vicinity of Hulgra, 11. *J. N. et George Rose 22232* (type) COLOMBIA, Dept. Antioquia, 1. *Daniel 615*.

Most similar to *Ctenopteris assurgens*, from which it is distinguished by acute segments.

7. *CTENOPTERIS RIGESCENS* (Bory) J. Smith.

Ctenopteris rigescens (Bory) J. SMITH, Hist. Fil. (1875) 184.

Polypodium rigescens BORY: WILLDENOW, Sp. Pl. V (1810) 183;

HOOKER & GREV. Icones Plate 216; METTENIUS, Pol. 42; C. CHR. Pterid. Madagascar 154.

Polypodium moniliforme var. *rigescens* HOOKER, Sp. Fil.-IV (1862) 182.

"P. frondibus linearibus pinnatifidis stipitatis glabris, laciniis oblongis obtusis integerrimis coriaceis, soris solitariis pilosis demum confluentibus."

"Habitat in arboribus montium insulae Borboniae."

"Stipes fuscus pollicaris vel sesquipollicaris. Frondes tripollicares et longiores lineares pinnatifidae, laciniis alternis coriaceis oblongis obtusis

glabris integerrimis. Sori subrotundi pilis raris longis instructi, solitarii, demum confluentes. Simillimum sequenti (*P. trichomanides*), sed rachi frondis glabra, stipite longiore, glabris coriaceis satis diversum."—Willd., l. c.

"*Polypodium rigescens* appears to be known only by the description of Willdenow in the *Species Plantarum*. We are indebted to M. Desvaux for an authentic specimen, which we have here figured and described."

"Caudex ut videtur brevis, repens, ...

"Stipites vix bipollicares . . glabri, basin versus paleaceo-squamosi."

"Frondes digitales et ultra, erectae, rigidae, Laciniae ovato-oblongae . . . glabrae, subtus parce pilosae."

"Sori . . . pilis immixti." (Up to 4 pairs in figure).—H. & G., l. c.

I have seen no specimen from Bourbon or Madagascar, but accept the judgment of those who have compared them with American specimens and found them identical.

Mettenius, Pol. 42, for example, cited specimens from Madagascar and Venezuela as identical. In U. S. Nat. Herb. is a specimen from Bogota, l. Karsten, det. Mettenius; also, from Brazil, *Glaziov 3576* det. Karsten; from Colombia, *Lehmann 7383*, cited by Hieronymus, Bot. Jahrb. 34: 503, as *forma genuina*; from Santo Domingo, *Fuertes 1777*, det. Brause. Other Colombia collections are *Killip, et al. 9461*; *Killip & A. C. Smith 20249, 20645*; *Pennell & Hazen 9935, 10074*; *Cuatrecasas 1199, 1336, 17953*; *Ariste Joseph*; *Karsten*; from Peru, *Bues 1786, 1955, 2117*; *Killip & Smith 24847*; from Bolivia, *Williams 1163 (?)*; from Brazil, *Brade 6469, 9790, Dusen 13987, Luétgelburg 846, 6001, 6091, 7187, Rose & Russell 21287*.

The conspicuous distinction of *Ctenopteris rigescens* from *Ctenopteris moniliformis* is that the former has pinnæ or segments more than twice as long as wide, and narrower at the apex. In consequence, the sori are more numerous on *Ctenopteris rigescens*, at least six pairs in good fruit. Some setæ are almost always evident in the sori of *Ctenopteris rigescens*. Elsewhere on the lamina, a few setæ are sometimes present.

8. CTENOPTERIS JUBAEFORMIS (Kaulfuss) J. Smith.

Ctenopteris jubaeformis (Kaulfuss) J. SMITH, Hist. Fil. (1875) 184.

Polypodium jubaeforme KAULFUSS, Flora 6 (1823) 364; MAXON, Pterid. Porto Rico (1926) 411.

Polypodium confusum J. SMITH, London Jour. Bot. 1 (1842) 194.

Polypodium saccatum FÉE, Genera 239, VI Mem. (1853) 10, Plate 7, fig. 3.

"*P. frondibus linearibus pinnatis, pinnis adnatis decurrentibus oblongis, obtusis, margine parce ciliatis, capsulis nudis. Ist von P. suspensum (Linn.) Plum. t. 87, a. durch seine Kleinheit auffallend verschieden und kommt P. pendulum Swartz, Schkuhr, t. 10. am nächsten, von dem es sich dadurch unterscheidet, dass die Fiedern am Grunde nicht nach oben und unten breiter werdend, mit einander verwachsen sind, sondern blos nach unten herablaufen; ferner durch einzelne bisweilen gabelförmige Borsten am Rande und glatte Kapseln, welche bei P. pendulum Swartz grösser und stets mit einzelnen langen Borsten besetzt sind.*"—Kaulf., l. c. Martiniques *Sieber 353.*

"Rhizome . . . scales numerous, light brown, oblong-lanceolate to cordate-ovate, 2-3 mm. long, entire clathrate. Fronds . . . 10-30 cm. long, nearly exstipitate . . . attenuate at base and apex, pinnatisect, the rachis black . . .; segments numerous, firmly herbaceous . . . 4-10 mm. long, 1.5-4 mm. broad at the decurrent base, obtuse or acutish, entire, the lower ones broader and long-decurrent; costae concealed; veins simple . . .; sori 2-8 pairs, small, deeply impressed, usually contiguous at maturity and thrust against the recurved margin."—Maxon, l. c.

I would describe the texture as thinly coriaceous.

Throughout the West Indies, very common in the Lesser Antilles, rare in Jamaica; Trinidad, *Fendler 131, Maré 1088, Alexander 6287, Britton, Hazen & Mendelson 1367, Hombersley 335*; British Guiana, Schomburgh isotype of *P. confusum*; *Jenman 1*; Venezuela, Margarita, *Johnson 164*; Colombia, *Killip 35302, Daniel 2783.*

9. CTENOPTERIS PSEUDONUTANS (Christ & Rosenstock) Copeland, comb. nov.

Polypodium Pseudonutans CHRIST & ROSENSTOCK, Fedder's Repert. 5 (1918) 15.

"*Eupolypodium*: rhizomate lignoso, breviter repente, crassiusculo, paleis membranaceis, flaccidis, ferrugineis, glabris, ovato-lanceolatis, acuminatis, usque fere 10 mm longis, 3 mm latis densissime oblecto; . . . stipitibus confertis, firmis, erectis, 2½-5 cm fere longis, 2 mm crassis, . . . utrinque anguste lineatis, basi paleis ovalibus sordide flavidis laxe adpressis plus minusve velatis; . . . laminis lineari-lanceolatis . . . usque ad 30 cm vel ultra longis, 4½ cm latis, . . . facie superiore glabrerrima, inferiore praesertim ad costas et prope soros pilis ferrugineis, mollibus patentibus obsessis; costis . . . subtus pilosis; soris parenchymate leviter immersis, dorso venularum medio impositis, . . . in singulis pinnis 16-20-enis, pilis fuscis, sporothecia longe superantibus ornatis . . ."

"Hab. Ecuadoria . . . 3500 m. 1. Dr. A. Rimbach. (1907.)"

"Compared with *P. Sodiroi*, distinctions are: "Das rhizom ist stärker, kürzer, und mit hellbraunen, breiteren und schlafferen Schuppen bedeckt; der Blattstiel ist viel kürzer und derber, am Grunde von Schuppen dieth eingehüllt und besitzt zwei deutliche Randlinien; Rhachis und Costae sind unterseits mit langen braunen Haaren besetzt; die Segmente hängen am Grund stets mehr oder weniger zusammen, sind nicht falcate, sondern gerade und fast rechtwinkelig absteigend . . ."

The U. S. Nat. Herb. contains an ample isotype which differs from the description in that the paleæ are hardly 2 mm wide; the stipes are only 2 mm thick, and the fronds are at most 3.5 cm wide; sori superficial.

10. *CTENOPTERIS PILOSISSIMA* (Martens & Galeotti) Copeland, comb. nov.

Polypodium pilosissimum MARTENS ET GALEOTTI, Mém. Ac. Brux. 15 (1842) 39, Plate 9, fig. 2; LIEBMANN, Mex. Bregner (1849) 45; BAKER, Flora Bras. II 514; HIERONYMOUS, Bot. Jahrb. 34: 507.

Polypodium xiphopteroides LIEBMANN, Mex. Bregner (1849) 44.

Polypodium acrodontium FÉE, Crypt. Vasc. Bras. II (1872-3) 58, Plate 97, fig. 2.

"Fronde lineari-lanceolata, rufo-pilosissima, profunde pinnatifida, apice attenuato inciso-serrato; foliolis adnatis, distantibus, oblongo-linearibus, obtusis, margine subtus revoluto, infimis abbreviatis auriculatis; soris rotundis, magnis, biserialibus, subconfluentibus; stipite pilis rufis patentibus hirsutissimo; caudice repente, squamoso."

"Obs. Species affinis *Pol. cultrato* Willd., a quo differt hirsutie majori, laciniis angustioribus, margine revoluto, soris subconfluentibus."

"(Collect. H. Galeotti, nos. 6310 et 6379.)"—Mart. et Gal., l. c.

From Zacuapan, Ver., and Villa-Alta, Oaxaca, alt. 3,000 to 4,000 feet.

Rhizome usually and typically creeping, short and stout, but sometimes ascending or elongate and slender, paleæ brown, rarely iridescent, lanceolate-linear, attenuate, 2 to 4 mm long, entire; stipes more or less fascicled, or rarely remote, even 1 cm apart, more or less densely pilose, or glabrescent or rarely glabrous, 1 to 5 cm long or rarely longer; lamina 10 to 15 cm long, 3 cm wide, sometimes larger, contracted to both ends, pinnate, coriaceous, rachis dark-setose above, surface usually naked above, setose or rarely almost naked beneath; pinnæ entire, obtuse, adnate, the sides strongly deflexed; veins simple, ending under more or less evident hydathodes; sori terminal on the veins, medial on the lamina, often slightly impressed; sporangia naked, spores globose-tetrahedral.

The lamina is never densely pilose; it may be moderately so, or slightly so, or pilulose, or practically glabrous. It is always and characteristically coriaceous with deflexed margins, indicating affinity to *Ctenopteris moniliformis*.

MEXICO: *Galeotti* 6379, the second number cited in the original publication, a good frond in the U. S. Nat. Herb. *Liebmann* s. n., dwarfed plants; *Conzatti* 3533, various enough to look like a mixture of species, but accepted as showing range

of variation; *Pringle* 4288, dwarfed; *Purpus* 213, perfectly typical; *Hinton* 14326; *Sanchez* 366; *Lyonnet* 1378, 1480; *Matuda* 2379a.

GUATEMALA: *v. Tuerckheim* (Donnell-Smith) 479, II 1347, II 2409; *Skutch* 96c, some rhizomes long and slender, 454; *Standley* 58697, stipes densely setose, 61075, stipes glabrous, 62710; *Johnston* 416; *Brenkle* 61; *Williams* 14273, stipes glabrous.

COSTA RICA: *Maxon* 252; *Maxon & Harvey* 8281; *Standley* 39053, 39396, 39636, 39661; *Standley & Valerio* 48182, 49034, 51485; *Valerio* 302; *Werckle* s. n.; *Brade* 52. The foregoing are all typical in aspect. The stipes vary from fairly densely pilose to glabrescent. The rachises and costae vary from pilose or setose to almost naked. The surfaces are almost or completely glabrous. There are also fronds with the pinnæ horizontal or nearly so, *Maxon & Harvey* 8421; *Standley* 34919, 42344, 43031; *Valerio* 134; and their stipes are short and pilose. They look distinct, but several of them have typical fronds as well as the peculiar ones, which compels me to regard the peculiar ones as variant within the species.

PANAMA: *Killip* 5415, with long castaneous hairs in and around the sori, but not on sporangia, 5472, sparsely hairy; *Maxon* 5720; *Cornman* 957, 1044, 1111, 1329; *Woodson, Allen & Seibert* 1064.

COLOMBIA: *Henri-Stanislas* 1706; *Charactier* 54; *Ariste-Joseph* A 81 and three sheets s. n.; *Killip & Smith* 15858. Colombian specimens are atypically large and dark.

VENEZUELA: *Moritz* 216, 382; *Fendler* 219; *Gollmer*; *Pittier* 10021, 10072; *Allart* 437; *Tate* 766; *Steyermark* 59910.

ECUADOR: *Mexia* 7353a.

PERU: *Bryan* 629; *Schunke* 514; *MacBride* 4330; *Vargas* 2220.

BOLIVIA: *Buchtien* 5258; *Cardenas* 3161; *Williams* 1164; *Herzog* 2190b. Peruvian and Bolivian specimens have long rhizomes and stipes.

BRAZIL: *Damasio* 978A; *Brade* 6912, 9432; (*Waxket*) *Rosenstock* 393; *Mexia* 4060; *Leite* 3887.

11. CTENOPTERIS MEGALOURA Copeland, sp. nov.

C. rhizomate breve paleis plumbeis 3 mm longis vix 1 mm latis attenuatis integris vestito; stipitibus caespitosis, 3-4 cm longis, pilis 1 mm longis, rufo-brunneis multis obsitis; lamina pendente, 20-30 cm longa, lineare (rarius lanceolata), utrinque

attenuata, deorsum tantum pinnata, sursum profunde pinnatifida, apice in caudam usque ad 5 cm longam integram vel deorsum lobatam contracta; rhachi inferne obscura setis minutis nigris vestita; pinnis patentibus integris obtusis, 2-2.5 mm latis, subcoriaceis; soris venis simplices terminantibus, medialibus, superficialibus; sporangiis glabris, cellulis incrassatis annuli 12-14, sporis globosis.

GUATEMALA: Coban, alt. 1,350 meters; 1. *v. Tuerckheim II* 1855. Type in U. S. Nat. Herb., presented by Donnell-Smith.

12. *CTENOPTERIS SODIROI* (Christ et Rosenstock) Copeland, comb. nov.

Polypodium Sodiroi CHRIST & ROSENSTOCK, Fedde's Repert. 5 (1908) 14.

Omitting less essential items, the original description can be boiled down to:

"Eupolypodium; rhizomate longe repente, paleis fuscis anguste lanceolatis in apicem fibrillosum piliformem desinentibus, c. 8 mm longis, 1 mm latis integerrimis densissime obtecto; stipitibus elastice decurvatis, 5-10 cm longis, vix $\frac{1}{2}$ mm crassis, mox glaberrimis; laminis basin versus brevius, apice longe attenuatis, usque ad 20-30 cm longis, 2-3 cm latis, profundissime pinnatifidis, rigide coriaceis, glaberrimis; segmentis lanceolatis, acutiusculis, mediis usque ad 1-2 cm longis, 3-4 mm supra basin latis, venis numero 6-10 a costa sub angulo 45° utrinque egredientibus; soris pilis atrofuscis brevibus sporotheciis vix superantibus ornatis."

ECUADOR: E. side of Tungurahua, alt. 3,500 m; *Rimbach* 1887, *Rosenstock Fil. Ecuad.* 13.

In hand are 5 sheets of the type collection. *Rimbach* 20, from the same locality, is identical. *Wiggins* 10619, from Volcan de Chile, Ecuador, is narrower; but it and *Pennell & Killip* 1379 from Colombia probably belong here. *Wiggins* 10407 from Cayambe Peak, and *Cuatrecasas* 11920 from Colombia, have broader fronds with more attenuate base, but are not specifically different. Smaller, weaker plants probably representing this species in imperfect development are *Lille* 17 and *s. n.*, *Popenoe s. n.*, and *Penland & Summers* 338a.

Ctenopteris Sodiroi is well characterized by the long, exceedingly scaly rhizome and the long segments.

13. *CTENOPTERIS SUBCAPILLARIS* (Christ) Copeland, comb. nov.

Polypodium subcapillare CHRIST, Bull. Boiss. II 5 (1905) 1.

Rhizome short, ascending or erect, paleæ fuscous, about 1 mm long, entire; stipes 0 to 2 cm long, filiform, congested,

fuscous, naked, lamina about 15 cm long 2 to 2.5 cm broad, attenuate to both ends, the lowest pinnæ reduced to short, broad wings; rachis black, filiform, naked unless for a few fibrils; segments or pinnæ 2 to 2.5 wide, acute, the base completely adnate on the acroscopic side, decurrent nearly or quite to the next segment, entire, glabrous, thin-coriaceous; sori small, medial, about 8 in a row on the medial segments, conspicuously impressed, sporangia naked.

COSTA RICA: La Palma, *Werkle 17033*, type in the Bonaparte Herbarium; photograph and fragment in U.S. Nat. Herbarium; *Standley & Valerio 47022*, from Province of Cartago, alt. 900 m.

Errors or misprints in the original publication make this species unrecognizable except for the photograph and fragment.

14. *CTENOPTERIS MILITARIS* (Maxon) Copeland, comb. nov.

Polypodium militare MAXON, Cont. Gray Herb. 165: 71, Plate 6.

"*Eupolypodium*. Rhizoma repens, 2-3 cm. longum, ca. 1 mm. diam., copiose palaceum, paleis . . . 2-3 mm. longis, 0.5-0.8 mm. latis, laxe ciliatis (ciliis ca. 2 mm. longis, ochroleucis, Folia . . . rigide erecta, 10-18 cm. longa; stipites ca. 1 cm. longi, 0.5-0.7 mm. diam., . . . primum dense et minutissime puberuli; . . . laminae ligulatae, 9-17 cm. longae, 2-3.5 mm. latae, glaberrimae; . . . segmenta crasse coriacea . . . valde obliqua, ambitu inaequaliter deltoidea, . . . valde concava, fertilia praesertim fere saccata. . . . venulis utrinque 1 vel 2 . . . sori solitarii, saepe basi venulae distalis aut anterioris aut posterioris siti . . ."

". . . Paramo de Sonson, Dept. of Antioquia, alt. 2700-2850 meters."

"The relationship of *Polypodium militare* is clearly with *Polypodium humile* Mett., from the same region . . . The two are similar in their rhizome scales, size, and perfectly glabrous, rigidly coriaceous blades, but *Polypodium humile* may be distinguished by its broader blades, less oblique segments, and more numerous sori . . . whereas *Polypodium militare* is invariably monosporous. The deeply cavernous segments are a remarkable feature."

Known by the type collection only.

15. *CTENOPTERIS HUMILES* (Mettenius) Copeland, comb. nov.

Polypodium humile METTENIUS, Ann. Sc. Nat. V 2 (1864) 251.

"Rhizoma repens, paleis sordide fuscis lanceolatis acuminatis margine dense ciliato-setosis vestitum; folia subcoriacea laete viridis glaberrima; petiolus $\frac{1}{2}$ - $\frac{3}{4}$ " longus gracilis teres tenuissime pubescens; lamina 3-7" longa, 3-4" lata, linearis, utrinque attenuata ad costam pinnatipartita; laciniae numerosae contiguæ oblique patentæ ovato-semioblongae obtusae integerrimae, nervi subimmersi catadromi pauci utrinque 1-3, supra sub faveola nigricante desinentes; sori subapicales; setae sporangiis admixtae nullae."

"Bogota, Chapinero, altit. 2700 metr. (Coll. Lindig. n. 137)."

"Obs.-Habit P. moniliformis Lag., a quo vero soris nisi nervorum apice extremo superatis, paleis rhizomatis ciliato-setosis longe recedit."

The U. S. Nat. Herb. contains several fragments of the type collection, *Lindig 137*, and one more recent collection, *Apollinaire & Arthur 142*, which matches the type perfectly. There are usually two veinlets on each side of the costa; and 1 to 3 (commonly 2) sori on each segment. The receptacle may be subapical on the veinlet, but the developed sorus covers the apex completely.

16. CTENOPTERIS TAMANDAREI (Rosenstock) Copeland, comb. nov.

Polypodium Tamandarei ROSENSTOCK, Hedw. 56 (1915) 369.

"*Eupolypodium*: rhizomate breviter repente, paleis lanceolatis, acuminatis, ad 5 mm longis, margine hyalino-ciliatis dense vestito; stipitibus densis, c. 2 cm longis, vix 1 mm medio crassis, minute tomentoso-hirtis; laminis e basi longe angustata lineari-oblongis, apice obtusiusculo, ad 12 cm longis, 12 mm medio latis, subcoriaceis, usque fere ad costam pinnatifidis, costa mediana excepta utrinque glaberrimis; segmentis medialibus suberecto-patentibus, approximatis, sinubus linearibus vel acutis interstinctis, e basi paullo angustata, anteriore subinciso-contracta, posteriore subdecurrenti lienari-oblongis vel linearibus, obtusis, inteberrimis, margine plano vel subreflexo, maximis ad 7 mm longis, 4 mm latis, inferioribus sensim decrescentibus et sinubus latioribus separatis, infimis vix 1 mm longis $1\frac{1}{2}$ m basi latis, superioribus medialibus subaequalibus, summis in apicem brevem, subintegrum cito transeuntibus; costa medians utrinque prominente, pilis subulatis supra sparse hirta, subtus glaberrima et aterrima; costis venisque immersis, venis simplicibus, utrinque ad 3 (-4), luce permissa conspicuis, apice incrassato, foveola fusciscenti supra notato, a margine remoto desinentibus; soris magnis, rotundatis, apices praecipue segmentorum occupantibus."

"Brasilia; Est. Rio de Janeiro, Serra do Itatiaya, ad rupes umbrosas, 4-10 VI, 1913, 11. F. Tamandaré et A. C. Brade, no. 6466."

Resembles *Polypodium Tunguraguae* Ros.

Isotype (or type) in Herb. Univ. Calif.

17. CTENOPTERIS TUNGURAGUAE (Rosenstock) Copeland, comb. nov.

Polypodium Tunguraguae ROSENSTOCK, Fedde's Repert. 7 (1909) 307.

"*Eupolypodium*: rhizomate breviter repente vel adscendente, paleis remotis 2 mm fere crasso, dense paleaceo; paleis e basi cordata lanceolatis, lineari-acuminatis, margine ciliatis (ciliis hyalinis piliformibus patentibus vel suberectis, c. 90 in paleis majoribus numeratis), e cellulis triplo fere longioribus quam latis, parietibus, fuscis lumine flavido praeditis, supra basin c. 12 seriatis, formatis, maximis usque ad 7 mm longis, $\frac{3}{4}$ mm supra basi latis; stipitibus subfasciculatis ad 6 cm longis, $1\frac{1}{2}$ mm medio crassis, teretibus, fuscis, minutissime tomentoso-hirtis; laminis elongato-oblongis, utro versus angustatis, c. 10 cm longis, 12 mm medio latis, rigide coriaceis, crassis, usque fere ad costam pinnatifidis, in apicem brevem lobulatum vel subintegrum, linearem acuminatis; segmentis lineari-lingulatis, obtusis, recte patentibus vel suberectis, strictis, sinubus angustis, basi rotundatis interstinctis, integerrimis, margine

plano vel paullum deflexo, supra glabriusculis, subtus setis fuscis, e basi incrassata plerisque inaequaliter furcatis sparse obsitis, supramedialibus maximis 6 mm fere elongis, $3\frac{1}{2}$ mm medio latis, inferioribus sensim diminutis, basalibus vix ultra 2 mm longis et paullo latioribus; costa laminarum atterima, utrinque prominente et breviter setoso-hirta, costis segmentorum parenchymate omnino obtectis, utrinque planis vel supra paullulum prominentibus; nervis lateralibus c. 7-jugis, simplicibus, immersis et inconspicuis, apice incrassato, foveola fusca supra notato prope marginem desinentibus; soris superficialibus, magnis, rotundis maturis confluentibus et totam paginam intra costam et marginem tegentibus."—Ros., l. c.

ECUADOR: Mt. Tunguragua. *Spruce s. n.* in Herb Bona-parte.

Compares *Polypodium pilosissimum* M. & G. and *Polypodium cuencanum* Hieron. and *Polypodium Stübelii* Hieron.

18. CTENOPTERIS CILIOLEPIS (C. Chr.) Copeland, comb. nov.

Polypodium ciliolepis C. CHR., Ark. vor Bot. 20 A (1926) 21.

"*Eupolypodium rhizomate* breve adscendente, squamis late lanceolatis acuminatis reticulatis nitidis atrobrunneis longe fimbriatis dense obtecto. *Stipitibus* fasciculatis 5-7, 1-2 cm longis cum rachibus ebeneis, elasticis, pilis brevissimis albidulis sparse scabris. *Lamina* lanceolata, ad 10 cm. longa, medio 12-13 mm. lata, curvata, papyracea, textura crassa, supra intense subtus glauco-viridi, glabra, e medio utrinque sensim angustata, parte inferiore pinnata, sursum profundissime pinnatifida. Pinnis vel *segmentis* ad 50 jugis, inferioribus sensim reductis, infimis vix 1 mm. longis et latis, medialibus c. 8 mm. longis, 2.5 cm. latis, oblongis obtusis, integerrimis, basi late ad rachin adnatis, interstitiis 0.5 mm. latis sinibus rotundatis separatis, supremis confluentibus. *Venis* inconspicuis 5-6 jugis, simplicibus, apicibus calvatis intra marginem desinentibus. *Soris* 4-5 quoque costae latere, magnis, non vel levissime immersis, confluentibus, superficiem totam partis exterioris pinnarum tegentibus, paraphysibus nullis.

"Prov. Sur Yungas. El Chaco, c. 900 m. (n. 1501, type specimen); between San Felipe and El Chaco, c. 2500 m. (n. 1430)."

Collected by Asplund.

Same species said to be in Brazil, *Glaziov 3341, 16639*.

"It is evident that *Polypodium ciliolepis*, in most characters, habit, size, cutting, black elastic rachis and thick texture, closely agrees with *Polypodium rigescens* Bory, but it differs from it greatly by its long fimbriated scales, and by the sori being confined to the outer half or two-thirds of the segment . . ."

An excellent isotype is in the U. S. Nat. Herb. The pinnæ are 3 mm (not 2.5 cm) wide; margins narrowly deflexed. The sporangia are naked.

Christensen refers to this species *Glaziov 3341, 16631*, from Brazil, named otherwise by Fée and by Baker, but I do not believe that Christensen is correct.

19. *CTENOPTERIS ALLOSUROIDES* (Rosenstock) Copeland, comb. nov.

Polypodium allosuroides ROSENSTOCK, Meded. Rijks. Herb. Leiden 19 (1913) 16.

"Eupolypodium: rhizomate caespitoso, paleis parvis, lanceolatis, margine dentato-ciliatis instructo; stipitibus debilibus, filiformibus, flexuosis, purpureo-brunneis, breviter hirsutis, 4-6 cm longis; laminis ad 10 cm longis, 1 cm medio latis, e basi angustata elongato-lanceolatis, subcoriaceis, viridibus, in parenchymate sparse pilosis vel glabrescentibus, pinnatis; pinnis multijugis (ad 30-40 utrinque), alternis, erectis, approximatis, inferioribus remotioribus, sessilibus, e basi angustata adnata ovalibus s. oblongis, obtusis, margine in statu provectiore omnino revoluti, inde circumscriptione lineari-oblongis, acutis, facie superiore in sicco corrugata, margine obscure crenulato, medialibus maximis 6 mm fere longis, 1.5 mm in statu revoluti latis, inferioribus paulo abbreviatis, superioribus gradatim diminutis et in apicem perhrevem, lobatocrenatum sensim transeuntibus; rhachibus pendulis, atropurpureis, pilis brevibus, mollibus, griseis adspersis; venis simplicibus, 2-6 utrinque, aegre conspicuis, apice soriferis; soris rotundis, confluentibus, margine revolto primum obtectis."

"Hab. in valle Lagodos, in fissuris rupium umbrosis, 4000 m. alt., mense Octubri 1911. Dr. Th. Herzog (no 2373)."

Collected only once. Isotypes in Herb. Univ. Calif. and U. S. Nat. Herb., both with numerous fronds, but without rhizomes. Sporangia naked; spores globose-tetrahedral.

An unique species. No other known *Ctenopteris* has such reflexed margins; the resemblance is most strikingly to *Onychium*.

20. *CTENOPTERIS CUENCANA* (Hieronymus) Copeland, comb. nov.

Polypodium cuencanum HIERONYMUS, Bot. Jahrb. 34 (1904) 505.

"Eupolypodium: rhizomatibus brevibus, . . . c. 3 mm crassis . . . paleis . . . basi excepta margine ubique ciliatis (ciliis rigidis, patentibus, fuscis, usque ad 0.15 mm longis) . . . petiolis teretibus, usque ad 1½ cm longis, fere usque ad 1 mm crassis, . . . setis subferrugineo-fuscis usque ad 1½ cm longis . . . dense vestitis; laminis rigidis, . . . usque ad 1½ dm longis, 1½ cm latis; costis supra hirtis planis, subtus dense setoso-hirsutis; . . . segmentis utrinque sensim decrescentibus . . . margine saepe revolutis, apice obtusis, subtus sparse setoso-pilosis . . . venulis utrinque 2-4; . . . soris . . . usque ad 8 in segmentis majoribus . . ."

ECUADOR, on W. side of Cordillera Occidental de Cuenca, alt. 2,400 to 2,800 m; *Lehmann 5728*.

Not certainly known except by the type collection, of which an excellent isotype is in the U. S. Nat. Herb.

Miller & Griscom 159, from Nicaragua, is smaller and more setose, but can probably be placed here.

21. *CTENOPTERIS PENNELLII* Copeland, sp. nov.

Plate 2.

C. gregis *C. pseudonutantis* rhizomate repente 15 mm crasso, paleis castaneis usque ad 12 mm longis 0.5 mm latis permultis occulto; stipitibus approximatis, 3–6 cm longis 1 mm crassis teretibus, setis 1–1.6 mm longis persistentibus ornatis; lamina 30–35 cm longa, 3 cm lata, utrinque attenuata usque ad rhachin nigram pinnata, ad soros conspicue alibi sparsius setosa; pinnis fere horizontalibus, contiguis, supra basin 2.5–3 mm latis, apice rotundatis. coriaceis, inferne primo pallidis demum brunescens; venis occultis sed numectatis sat conspicuis, ad marginem fere attingentibus; soris usque ad 8–(saepius 5–) paribus, medialibus.

COLOMBIA: Dept. El Cauca, Cordillera Occidental, alt. 2,400 to 2,700 m; *1. Pennell et Killip 7379*.

Larger and more coriaceous than *Ctenopteris rigescens*. Similar and related to *Ctenopteris pseudonutans*, from which it is distinguished by darker, firmer, narrower paleæ, greater hairiness and more nearly horizontal pinnæ; common features are large size, rounded apices of pinnæ, and numerous sori placed midway on the veins.

22. *CTENOPTERIS CONGESTA* Copeland, sp. nov.

Plate 3.

C. (rhizoma invisum) stipite filiforme 0.5 mm crasso, debile, setoso glabrescente, 3–5 cm longo, sursum vestigiis paucis pinnarum vix 1 mm longis donato; lamina ca. 15 cm longa, 4 mm lata, pinnata, rhachi dense setosa, setis atrocastaneis 2 mm longis, pinnis orbiculari-oblongis plerisque 3–4 mm longis, 2–3 mm latis, semi-adnatis sursumflexis et deinde dense imbricatis, rigide coriaceis setosis; soris ad pinnam quamque 4–6, sporangiis nudis, opacis, cellulis incrassatis annuli ca. 13.

PERU: La Convencion, alt. 13,000 to 14,000 feet; *1. Bues 2172*. September 27, 1934.

The collection consists of very numerous fronds. probably densely tufted, but without rhizome. The slender, mostly curved stipes suggest pendulous fronds, but pendulous fronds are not usually hard-coriaceous and are not usually found at such altitudes. The pinnæ are all bent upward, back to back, exposing the confluent sori. No other known member of the group of *Ctenopteris moniliformis* approaches this one in denseness of setæ.

GROUP OF CTENOPTERIS SENILIS

(Pinnæ minute, remote)

Key to the species

Pinnæ oblong.

Pinnæ glabrous 3. *C. itatimensis*

Pinnæ setose.

Pinnæ 2 to 3 mm long 2. *C. subtilis*Pinnæ 5 to 10 mm long 1. *C. senilis*

Pinnæ flabellate or obovate.

Paleæ and sporangia conspicuously hairy 4. *C. subflabelliformis*Paleæ and sporangia naked 5. *C. flabelliformis*

1. CTENOPTERIS SENILIS (Fée) Copeland, comb. nov.

Polypodium senile FÉE, 7 Me. Mém. (1857) 25, fig. 1.*Polypodium flabelliforme* HOOKER, Sp. IV 187 partim, non Poir.

"Frondibus basi et centro pinnatis, apice pinnatifidis, linearibus, pilis incanis onustis; petiolo rachique debilibus, capillaceis; frondulis sessilibus, basalibus rotundis, alteris ovatis, viridibus, lamina inferiore pilosior; sporotheciis rufis, 3-4, pilis rufis, longissimis, numerosisque circumdatis; sporangiis ovideis, pilos tenuissimos, rigidos, longissimos ferentibus; sporis subreniformibus; surculo parvulo."

"Habitat in Novo-Granatensi, provincia Ocaña. 1. Schlim, No. 364."

"Filix mollis. delicatissima, petiolo rachique capilliformibus; facie Asplenii Trichomanis, sed villosissima."—Fée, l. c.

Fée remarks that no other species has such long hairs on the sporangia.

Paleæ 1 to 1.5 mm long, ciliate; stipes commonly 1 cm long, slender, pilose, densely fascicled, with consequent suppression of the paleæ, in well developed plants. Well developed fronds 25 to 30 cm long, about 2 cm wide, pinnate, rachis black, filiform, moderately pilose; pinnæ typically oblong, not quite contiguous, rounded at apex, base often slightly gibbous, half-adnate on the acropetal side, short-decurrent leaving less than half of the rachis winged, herbaceous; veins simple; sori inframedial, most commonly 5 in a row; hairs on sporangia many (often 6), 2 to 4 times the diameter of the sporangia. I find the spores globose-tetrahedral.

Specimens: COLOMBIA, *Lehmann* 8945, *Killip* 6785, 34283, *Killip & Smith* 17847, *Killip & Garcia* 33196, *Seifrizz* 99, *Figueroa* 884, *Martin* 3729; PANAMA, *Maxon* 5476, *Allen* 1433 (young, approaching *C. subflabelliformis*); COSTA RICA, *Pittier* 1936, 13248, 13264, *Tonduz* 4180, 10706, *Standley* 35045, 35188, 36636, 42734, 42776, *Maxon & Harvey* 8450a, *Torres* 2, 27; GUATEMALA, (*Heyde & Luz*) *Donnell-Smith* 4686; VENEZUELA, *Fendler* 209

(reduced to *Pol. flabelliforme* by Hooker, Sp. Fil. IV 187, mis-cited as *P. sessile*), Tate 197, Pittier 9189, 9999, 10071, Allart 300, Steyermark 55238, 55445 (Some Venezuela fronds are narrowly linear); SANTO DOMINGO, Krug & Urban (?), juvenile; CUBA, Acuña 9978, Morton & Acuña 3144, Seifríz 1085 Ekman 5500, 14557, Leon 11127. Cuban specimens tend to have short, roundish pinnæ.

2. CTENOPTERIS SUBTILIS J. Smith.

Ctenopteris subtilis (Kunze) J. SMITH, Hist. Fil. (1875) 184.

Polypodium subtile KUNZE apud KLOTZSCH, Linnaea 20 (1847) 325.

"Frondebis caespitosis, linearibus, gracillimis, flexilibus, tenuissime membranaceis, pendulis, pinnatifidis, obtusis, utrinque attenuatis, sparsim pilosis, breviter stipitatis; laciniis semiovatis, obtusis ovatis, leviter repandis, tri-pentastoris; venis pinnatim ramosis; soris parvis, sordide-fuscis, ad paginam superiorem impressis, niveo-crustaceis; stipite brevi, filiformi rhachique nigricante, piloso."

"Frondes 3-5 poll. longae, subflexuosae, delicatulae, 2-4 lin. latae. Lacinae 1-2 lin. longae, $\frac{1}{2}$ -1 lin. latae. Stipes 2 linearis."

"In rupibus ad Meridam Columbiae." Moritz n. 325 (65).

"*A. P. lanigero* Desv. differt: laciniis brevioribus, fertilibus supra punctulis niveo-crustaceis; stipite brevissimo."—Kunze, l.c.

Paleæ small and inconspicuous, ciliate; stipe up to 1 cm long, hairy; pinnæ 3 to 4 mm long by 2 mm wide, rounded at apex, dilated at base and fully adnate, contiguous, connected or not quite connected, herbaceous, surfaces beset with pale hairs 1.5 to 2.0 mm long; veins short, simple; sori medial, small; sporangia apparently naked.

Type fragment in U. S. Nat. Herb. Other specimens: COLOMBIA, Lehmann 7351, 7381, 7654, KK 114, Pittier 1681, Killip 11382; PANAMA, Killip 5289, Cornman 1299; COSTA RICA, Maxon & Harvey 8450, 8462, Brade 8288, Standley 38373, 50476, Standley & Valerio 48174, 50575, 51608, 52290, Valerio 167, 193, Torres 63, 69, Skutch 2830; GUATEMALA, Tuerckheim 964, Hatch & Wilson 168.

3. CTENOPTERIS ITATIMENSIS (C. Chr.) Copeland, comb. nov.

Polypodium itatimense C. CHR., Index Suppl. III (1934) 151.

Polypodium saxicola ROSENSTOCK, Fedde's Repert. 21 (1925) 348, non, Sw.

"Eupolipodium; rhizoma repens, caespitosum, radiculis capillaribus crebris instructum, paleis lanceolatis, brunneis, longe griseo-ciliatis obsitum; stipites 1-1½ cm longi, atrobrunnei, pilis brevibus, patentibus puberuli; rachides graciles, flexuosae, infra pilis paucis adpersae, supra glabrae; laminae ad 10 cm longae, 12 mm medio latae, oblongo-lanceolatae, utrinque attenuatae, herbaceae, virides, glaberrimae, profundissime pinnatifidae;

segmenta patentia, alterna, subapproximata, media maxima c. 6 mm longa, 3 mm lata, ligulata, obtusa margine subundulato, inferiora sensim, superiora citius decrescentia; nervi utrinque 3-4, simplices, apice soriferi; sori rotundati, mediales, subimmersi, in facie superiore cavitate laminae notati; capsulae inermes."

"Brasilia: Est. Sao Paulo, Serra de Itatim. 1000 m alt. ad saxa. III. 1924 leg. A. C. Brade no. 9274."

Superficially resembles *Polypodium subtile* Kze. Known only by the "original" collection, so designated on the label in the Herb. Univ. Calif. received from Rosenstock. The collector's number is 8274.

The paleae are inconspicuous, 2 mm long, and apparently glabrous. The description is otherwise correct. *Ctenopteris subtilis* (Kze.) is distinguishable by hairiness.

4. *CTENOPTERIS SUBFLABELLIFORMIS* (Rosenstock) Copeland, comb. nov.

Polypodium subflabelliforme ROSENSTOCK, Fedde's Repert. 7 (1909) 306.

Polypodium senile var. *minor* ROSENSTOCK, Meded. Rijks Herb. Leiden 19 (1913) 19.

"Eupolypodium: rhizomate brevi, erecto, apice paleaceo, paleis ovali-linearibus, obtusis, vix ultra 1 mm longis, 0.4 mm latis, ochraceis, pilis setiformibus . . . dense ornatis; stipitibus fasciculatis, 5-6 longis, cum rhachibus filiformibus, nigris, pilis 1 mm fere longis, patentibus, mollibus, fulvidis vestitis; laminis lineari-oblongis, deorsum breviter, sursum parvum angustatis, subcurvatis, membranaceo-herbaceis, obscure viridibus, utrinque pilis iis stipitum similibus . . . instructis, pinnatis, pinnis sessilibus, discretis, basi 1-1 1/2 mm distantibus, basi angustata . . . inframedialibus maximis 5 mm fere longis, 2.5 mm latis; soris apicibus costarum et ramorum impositis, in pinna qualibet solitariis aut binis vel ternis, rotundis, magnis, ultra 1 mm diametentibus."

"Hab. Equatoria: in monte Abitagua Andium Quitensim. 1. Spruce, no. 5271."—Rosenstock, l.c.

Described from a small specimen; the narrowly linear fronds may be 30 cm long, not more than 8 mm wide; remarkable for the hairiness of paleae and sporangia. Our isotype of *Polypodium senile* var. *minor* has these hairs up to 1 mm long; otherwise it is exactly *Ctenopteris subflabelliformis*, and I feel sure that it belongs here, rather in *Ctenopteris senilis*. The narrowly adnate pinnæ leave the filiform black rachis mostly wingless veins simple.

Specimens: BOLIVIA, Herzog 1985, isotypes of *Polypodium senile* var. *minor*; Williams 1168, 1169, 2607, Cardenos 1233; PERU, Bryan 730, Bues A 34, 529, 1812.

5. CTENOPTERIS FLABELLIFORMIS (Poirot) J. Smith.

Ctenopteris flabelliformis (Poirot) J. Smith, Hist. Fil. (1875) 184.

Polypodium flabelliforme POIRET, Enc. V. (1804) 519.

Poligosorum METENIUS, Linnaea 36 (1869) 132, non. Kl. (1847).

"Polypodium fronde angustissima, elongata, pendula; lobis alternis, obtusis (N).

"Polypodium aliud pendulum, minimum. Plum. Fil. pag. 68. tab. 87."

"Polypodium lonchitidis folio, angustissimo, pendulum. Pet. Fil. tab. 10, fig. 1."

"A. Idem. fronde breviori, lobis longioribus. (N)

"Cette espèce a tellement la forme du *polypodium suspensum*, qu'un est tenté de ne la regarder que comme une variété de cette plante; néanmoins ses feuilles longues, très étroite lui donnent un port particulier qui la rend facile à distinguer. Elle est glabre dans toutes ses parties; ses lobes sont alternes, obtus, arrondis à leur sommet. La variété A, beaucoup plus petite, a les feuilles de deux tiers plus courtes, & ses lobes plus étroits, mais plus longés."

"Cette plante croit in Martinique, sur le tronc des vieux arbres, d'où ses feuilles pendent vers la terre. (V. f. in herb. Juss. & Desfont.)—Poirot, l. c.

Paleæ 1 to 1.5 mm long, fuscous, naked; stipe 0 to 5 mm long, usually winged to the rhizome; rachis black; segments adnate on the upper side, decurrent, rarely falling short of the next segment; veins usually 2 or 3 times forked, falling far short of margin; sori medial, eventually covering the segment; sporangia naked, annulus about 13 cells.

We have no specimen from Martinique, but from Guadeloupe have *Stehlé 1203, 1889, 2416, 4835*, all very small, the largest fronds 7.5 cm long, 7 mm wide.

The conspicuous distinctive feature of this species is its perfect nakedness.

GROUP OF CTENOPTERIS CAPILLARIS

(Small ferns, pinnæ toothed)

Key to the species

Fronds symmetrical.

Fronds pinnate, at least at base.

Stipe black.

Base of frond rounded 2. *C. melanopus*

Base of frond attenuate 3. *C. angustipes*

Stipe not black.

Fronds evidently stalked.

Rachis and margine black-setose 4. *C. achilleifolia*

Lamina naked or nearly so.

Pinnæ lobed.

Lamina 10 cm long 5. *C. nudipes*

Lamina 30 cm long 6. *C. athyrioides*

- Pinnæ crenate.
 Lamina membranaceous 8. *C. yungensis*
 Lamina subcoriaceous 7. *C. gracilis*
- Pinnæ undulate-crenate.
 Pinnæ remote 9. *C. pseudocapillaris*
 Pinnæ not very remote.
 Fronds broadly lanceolate.. 10. *C. graveolens*
 Fronds linear-lanceolate 11. *C. nubigena*
 Fronds sessile or nearly so..... 12. *C. Tmesipteris*
- Fronds pinnatifid.
 Paleæ entire.
 Pinnæ obliquely dilated 13. *C. suprasculpta*
 Pinnæ not obliquely dilated 1. *C. capillaris*
 Paleæ ciliate 14. *C. subsessilis*
 Fronds bipinnate 15. *C. myriophylla*
- Fronds asymmetrical.
 Sori dorsal.
 Pinnæ linear 1. *C. capillaris*
 Pinnæ round to oblong 16. *C. heteromorpha*
 Sori on marginal teeth 17. *C. podocarpa*

1. CTENOPTERIS CAPILLARIS (Desvaux) Copeland, comb. nov.

Polypodium capillare DESVAUX, Berl. Mag. 5 (1811) 316, Jour. Bot. 6: 262; BAKER, Syn. Fil. (1874) 329; CHRIST, Farnkr. der Erde (1897) 81; HIERONYMUS, Engler's Jahrb. 34 (1904) 508.

Polypodium pilipes HOOKER, Icones Pl. III (1840) 221; KL., Linnæa 20 (1847) 382; METTENIUS Pol. (1856) 51; HIERONYMUS, Hedw. 48 (1909) 254.

Polypodium blandum FÉE, VII Mém. (1857) 59, Plate 22, fig. 5.

Polypodium decipiens HOOKER, Sp. Fil. IV (1862) 231, Plate 279 B.

Ctenopteris decipiens J. SMITH, Hist. Fil. (1875) 185.

Polypodium pozuzoense BAKER apud HOOKER, Icones Pl. (1886) Plate 1672.

Polypodium fucoides CHRIST, Bull. Boiss. II 5 (1905) 2.

Polypodium crassulum MAXON, Cont. U. S. Nat. Herb. 17 (1916) 598.

"Rhizom kurz. Blattstiele gebüschelt, dünn, 3 cm lang. Blatt hängend, 3 dm lang und 8 cm breit, oval, gegen die Basis und die Spitze verschmälert. Fiedern zahlreich, mehr als um ihre Breite entfernt aber durch einen schief herablaufenden Flügel verbunden, 4 cm lang, breit lineal, 3 mm breit, ziemlich stumpf, grob and liegend gezähnt; am mittleren Theil des Blattes ist hier und da ausnahmsweise eine Fieder tief-fiederspaltig, mit verlängerten und wieder gezahnten Lappen. Textur krautig. Pflanze kahl. Farbe hellgelblich. In jeder Zahnung ein gegabelter Nerv. Sori an der Spitze der obern Gabel, oval, zahlreich.

Die Monstrosität wiederholter Fiederung an sonst einfach gefiederten Blättern ist hier ziemlich charakteristisch, wie auch an andern ähnlichen Polypodien: *P. pozuzoense* Baker und *P. turrialbæ* Christ . . ."—Christ, Farnkräuter, l.c.

I do not know what *Ctenopteris capillaris* (Desv.) really is, but accept Christ's description, conforming to most descriptions, and specimens so named. The most conspicuous, but not invariable, feature is the overgrowth and abnormal dissection of a part of the pinnæ, usually of a part of those of the upper half of the frond. So many such monstrosities of other ferns are known to be hybrid that we are justified in supposing this to be so. Even so, it is wide-spread and common enough to justify treating it as a species.

Hooker's figure of *Polypodium decipiens* shows only two conspicuously overgrown pinnæ. Fée's *Polypodium blandum* has no abnormal pinnæ. Hooker's *Polypodium pilipes* is drawn with all of the pinnæ of the broad part of the frond alike extravagantly developed. *Polypodium pozuzoense* has a part of the pinnæ developed without any order at all. Now, *Polypodium blandum* might be treated as a distinct and orderly species; but it must be expected to recur repeatedly in cultures of any moderately unstable forms. No one of the monstrous plants can be expected to breed true in such completeness as we expect of species.

Ctenopteris capillaris is unstable in other respects, as well as in the dissection of the fronds. The rhizome is stout, erect or nearly so. The paleæ are entire, linear, about 2 mm long, ferruginous to reddish-brown; but are largely suppressed by the crowded roots and densely hirsute bases of the crowded stipes. The fronds are glabrous except or unless for some amorphous squamulæ. Rosenstock, Meded. Rijksherb, Leyden 19 (1914) 17, mentions "grossen, kugeligen weissen Drüsen auf der Blattunterseite"; but I have not detected them.

The veins stand at an acute angle, commonly not wider than 30°. They are usually simple. The sori are terminal on the veins, medial or inframedial, but because of the narrowness of the segments project beyond the margin at maturity.

Specimens: PERU, Bues 940, 974, 1956, Bryan 626: COLOMBIA, Mortiz 337, cited in the description of *Pol. decipiens*, Pennell 4478: VENEZUELA, Tate 111 (?). BRITISH GUIANA, Mt. Roraima; COSTA RICA, Brade, the type of *P. crassulum*, Alfaro s. n., Werkle, (1903), type fragment of *Pol. fucoides*, 588, 1906, Lancaster 602, 716, Maxon & Harvey 8199, 8225, 8414 8466. A. Smith H19, Standley 38086, 38118, Standley & Valerio 48160, 48199, 48222, 50448, 50489, 50641, 50667, 50687, 52182, 52279, Valerio AA, A17, A.64, 53. Skutch 4379.

2. CTENOPTERIS MELANOPUS (Grev. et Hooker) Copeland, comb. nov.

Polypodium melanopus GREV. et HOOKER, Bot. Misc. 3 (1833) 384, Plate 111.

"Fronde oblonga seu oblongo-obovata caudatim attenuata pectinatim pinnatifida, laciniis linearibus integerrimis ciliatis, soris serialibus, stipite aterrimo nitido parce piloso. (Tab. CXI).

"Hab. Hanging vertically from the trunks of trees at Lurencucho, near Cuenca, at an elevation of about 9,000 feet above the level of the sea. Prof. M. Jameson."

"Stipes digitalis et ultra, gracilis, aterrimus, nitidus, parce setoso-pilosus. Frons spithamaea, circumscriptione oblonga seu oblongo-obovata, apice in caudam gracilem pinnatifidam 2 uncias longam attenuata, profunde pectinatim pinnatifida; laciniis sesqueuncialibus integerrimis obtusiusculis, ciliatis, pinnatim nervosis. Rachis seu costa primaria gracilis, atra, nitida, superne viridis. Sori in omnibus laciniis etiam in cauda seriatim dispositi, rotundi, costam inter et marginem. Capsulae globosae, longe stipitae, annulatae. Semina globoso-angulata, pellucida."

The illustration shows the pedicel of a single row of cells, and globose-tetrahedral spores. The shape of the frond is peculiar, broadcast above the middle, thence narrowed gradually to the broadly rounded base, abruptly narrowed to the caudate apex.

This species seems to remain known by the original collection; even Sodiro, Jameson's successor in Quito, cites Hooker as his authority.

I transfer the name because the pedicle and spores show it to be a *Ctenopteris*, and it is the oldest species in its group.

3. CTENOPTERIS ANGUSTIPES Copeland, sp. nov.

C. rhizomate breve erecto, paleis nigris lineari-lanceolatis dentibus minutis ciliatis ornatis; stipite 1-3 cm longo piloso; lamina oblanceolata 20 cm alta, 3 cm lata, deorsum longe attenuata, acuminata, tantum pinnata, rhachi facieque inferiore setis inconspicuis obsitis; segmentis integris obtusis, textura subcoriacea, opacis; venis simplicibus.

COLOMBIA, Dept. El Valle, alt. 1,900 to 2,200 m; on trees in dense forest. Killip & Garcia 33843.

4. CTENOPTERIS ACHILLEIFOLIA (Kaulfuss) J. Smith.

Ctenopteris achilleifolia (Kaulfuss) J. SMITH, Hist. Fil. (1875) 18b. *Polypodium achilleæfolium* KAULFUS, Enum. (1824) 116; KUNZE, Farnkräuter 43, plate 2; HOOKER, Sp. Fil. IV 225.

"P. frondibus pinnato-pinnatifidis, pinnis linearibus basi superiori adnatis pinnatifido-dentatis, utrinque rachique nigropilosa, soro solitario."

"Habibat in Brasilia. Otto communicavit."

"Frons bipollicaris vel paullo longior, rigida pinnata; pinnae infimae et supremae dentiformes, reliquae lineares alternae pinnatifido-dentatae basi superiori adnatae, utrinque pilis longis sparsis nigris hirtae. Stipes semipollicaris. Rachis hirta. Sori ad basin superiorem dentium solitarii subrotundi."

"Quoad frondium structuram, hirsutiem et situm sororum Polyp. trichomanoidi proximum, pinnis, vero linearibus pinnatifido-dentatis abunde diversum."—Kaulfuss, l. c.

Paleæ 3 mm long, linear-lanceolate, yellow turning brown, entire, naked. Lamina up to 15 by 5 cm segments 1.5 mm wide; black setæ sparse on surface and rachis. Annulus, 12 to 14 cells; spores tetrahedral.

The resemblance of the fronds of *Ctenopteris achilleifolia* and *Polypodium funiculum* FÉE, noted by Hooker, is superficial. The latter species, though transferred to *Ctenopteris* by J. Smith, seems to me to be a very peculiar *Polypodium*.

BRAZIL; Minas Geraes, Chase 9554; Rio Janeiro, Spannagel s. n.; Sao Paulo, Brade 6592, Leite 3449, Wacket 108; Santa Catharina, Rosenstock Fil. austro-Bras. 146; Espiritu Santo, Mexia 4056, 4059.

POLYPODIUM LONGISETOSUM Hooker.

Polypodium longisetosum HOOKER, Sp. Fil. IV (1862) 225, Plate 278 A.

"Caudex?, stipes 3 inches long slender flexuose deciduously villous, frond 8 inches long 2 inches wide membranaceous pendent very villous on both sides chiefly beneath and at the margin with long dark-brown spreading hairs, broad-lanceolate scarcely acuminate attenuated at the base with dwarfed distant pinnae deeply pinnatifid above, the rest pinnate, segments or pinnae 1 inch long, 1 line wide horizontally patent linear-oblong obtuse decurrent at the base, lower ones more distant than the upper ones, all pinnatifid about halfway down to the costa with subtriangular obtuse lobes or teeth, rachis filiform and slender, costule black, veins simple short one to each lobe bearing a globose sorus nearer the rachis than the margin.

Hab. Andes of Quito, Jameson, n. 79 . . . allied to *Polypodium achilleaeifolium* indeed, but differing in the larger size, the slenderer and flexuose rachis, the membranaceous and flaccid and pendent frond, incapable of supporting itself erect, the less deeply cut lobes of the pinnae or segments, and, above all, the copious and very long hairs, which render the whole plant conspicuously villous."

Apparently distinct; but I have seen no specimen.

5. CTENOPTERIS NUDIPIES Copeland, sp. nov.

Plate 4.

C. rhizomate breve, paleis vix 1 mm longis brunneis integris; stipitibus confertis, 1-2 cm longis, filiformibus, etiam prope rhizoma fere glabris, fuscis; lamina 10 cm longa, 2 cm lata,

utrinque abrupte angustata, rhachi nigra sparse puberula; pinnis lineari-oblongis subacutis, late adnatis, breviter decurrentibus, inciso-lobatis, papyraceis, brunneo-viridibus, inferne minutissime glanduloso-puberulis; venis simplicibus, brevibus; soris ad basin lobi quique solitariis; sporangiis nudis.

PANAMA: Volcan Chiriqui, alt. 10,400 ft; 1 *M. E. Davidson* 1022.

In gross appearance much like *Ctenopteris achilleifolia*; distinguished by comparatively naked stipes, and broader, more deeply toothed, less decurrent, puberulent pinnæ.

6. *CTENOPTERIS ATHYRIOIDES* (Hooker) Copeland, comb. nov.

Polypodium athyrioides HOOKER, Sp. Fil. IV (1862) 224, Plate 277 B.

"Eupolypodium: stipites 2 inches (or more) long hispid-hirsute as well as the rachis, frond 10 inches to nearly a foot long 2 inches wide subcoriaceous dark-brown when dry, glabrous (except in the undeveloped portion) lanceolate acuminate attenuated at the base pinnated throughout, pinnae numerous approximate from a broad quite sessile and adnate slightly auricled base gradually lanceolate acuminate pinnatifid about halfway down with ovate obtuse lobes except at the apex which is entire, lowest pinnae small triangular, veins internal simple terminating in a very conspicuous swollen clavate apex which bears the oval very prominent dull orange-colored sori one to each lobe a little distant from the costule."

"Hab. Pangoa, Peru, Mathews n. 1103."—Hooker, l. c.

A single modern collection, *Bues* 1822, from Rio Lachac, Valle de Lares, alt. 7,000 ft. Peru. This specimen, like the type is without the rhizome. It fits Hooker's description and plate perfectly.

Opaque, even if cleared with alcohol. Sporangia naked, globose; annulus, 12 cells.

7. *CTENOPTERIS GRACILIS* (Hooker) J. Smith.

Ctenopteris gracilis (Hooker) J. SMITH, Hist. Fil. (1875) 185.

Polypodium gracile HOOKER in H. & G., Icones Fil. (1831) 229; Sp. Fil. IV 224.

"Polypodium gracile; glabriusculum, frondibus linearibus pinnatis, pinnis lineari-oblongis sinuato-pinnatifidis subdecurrentibus, soris biserialibus demum confluentibus, stipite rachique gracillimis."

"Hab. Huaylluay, prope Pasco, in Andibus Peruvianis, Dom Cruckshanks."

"Caudex ut videtur brevis, crassitie pinnae anserinae, horizontalis, dense paleaceo-squamosus, inferne radicans; radicibus fibrosis, ramosis, tomentosus.

"Frons spithamea et ultra, linearis, pinnata. Rachis gracillima . . . Pinnae semiunciam ad unciam longae . . . subcoriaceae, pinnatifidae, obtusae . . ."

"Semina subglobosa."—H. & G., Icones."

The illustration in *Icones Filicum* should make this species confidently recognizable, but I have not been able to refer any specimen to it.

8. *CTENOPTERIS YUNGENSIS* (Rosenstock) Copeland, comb. nov.

Polypodium yungense ROSENSTOCK, Fedde's Repert. 5 (1908) 236.

"Eupolypodium; rhizomate erecto, paleis lanceolatis c. 2 mm longis, 1 mm basi latis, margine regulariter fimbriatis apice instructo; stipitibus fasciculatis, 2-3 cm longis, cum rhachibus tenuibus, teretibus, brunneis, pendulis, pilis fuscis 0.75 mm longis, patentibus sparse obsessis; laminis elongato-ovalibus, basi valde angustatis, apice acutis, membranaceis, pallide viridibus, rhachi excepta utrinque glabriusculis, 25 cm vel ultra longis, 3 cm latis, pinnatis; pinnis multijugis, sessilibus, approximatis, plerisque e basi late adnata, posteriore paullum decurrenti anguste linearibus, subfalcatis, margine obtuse serrato-crenatis, apice angustato-acuminato integerrimo, medialibus maximis, c. 1.5 cm longis, 3 mm basi latis, inferioribus 3-5 jugis repente abbreviatis, auriculiformibus, superioribus sensim, demum citius diminutis et in apicem brevem dentatum desinentibus; costis atterimis, utrinque prominulis; venis lateralibus usque ad 6-jugis, simplicibus, manifestis, basalibus exceptis omnibus soriferis; soris subovalibus majusculis."—Rose., l.c.

BOLIVIA: Yungas borealis; Unduavi, alt. 3,400 m; *Buchtien* 891.

Compared with *Polypodium capillare* Desv. and *Polypodium funiculum* Fée, which have linear, straight, not subfalcate pinnae, and different paleae. Sporangia naked.

Specimens: BOLIVIA, *Herzog* 2190, *Buchtien* 891, isotype, 2756, *Steinbach* 9554; PERU, *Bryan* 550B, *Bues* 1039, 1256, 1391, 1547, *MacBride* 4305, 4329, *MacBride & Featherstone* 1862, *Vargas, et al.* 10626, *Vargas* 11138.

9. *CTENOPTERIS PSEUDOCAPILLARIS* (Rosenstock) Copeland, comb. nov.

Polypodium pseudocapillare ROSENSTOCK, Meded. Rijks Herb., Leyden 19 (1914) 17.

"Eupolypodium; rhizomate caespitoso, erectiusculo, radicoso, paleis 1½-2 mm longis ¼ mm latis, lanceolatis brunneis, margine longe albido ciliatis ornato; stipitibus fasciculatis, 2-6 cm longis, cum rhachibus filiformibus, pendulis, flexuosis, purpureo-brunneis, pilis brevibus, griseis, furcatis stellatisve obsessis; laminis e basi parum angustata linearibus, ad 35 cm longis, 3-4 cm latis, herbaceis, viridibus, sparse pilosis, pinnatis; pinnis ad 30-jugis, 1 cm fere inter se distantibus, erectis, alternis, strictis, rarius subfalcatis, e basi subaequali, adnata, posteriore breviter decurrente linearibus, obtusiusculis, margine plano, integerrimo vel subrepando, ad 2½ cm longis 2½ mm latis, in parenchymate utrinque glaberrimis; costis supra immersis, subtus prominentibus et breviter hirtellis; venis lateralibus

usque ad 10 utrinque, simplicibus, strictis, sub angulo 45° e costa egredientibus, ad apicem soriferis; soris ad 8 utrinque, rotundis, costae potius quam margini appropinquatis."

"Hab. Tablas, ex aboribus dependens. 3,400 m alt., mense Majo 1911.

1. Dr. Th. Herzog (no. 2190a)."—Ros., l.c.

There follows a German discussion of the distinctions from *Polypodium capillare* Desv. and *Polypodium yungense* Ros.

The rhizome is wanting on most specimens, and those bearing it have roots and stipe-bases so crowded that the paleæ are mostly suppressed. I believe that when present the paleæ are pale-ciliate (as described), but this is not a conspicuous feature of the species. The bases of the stipes are only moderately pubescent. The stipes may reach a length of 10 cm. The angle of divergence of the veins is usually more acute than 45° . The sori are medial or slightly inframedial.

Conspicuous characters of *Ctenopteris pseudocapillaris* are the elongate filiform stipes and rachises, and the bases of the pinnæ, which, somewhat decurrent, are not enough so to connect the pinnæ; that is, the fronds are pinnate, not pinnatifid, throughout.

Tate 337, from Cacopunco, Bolivia, has a part of the pinnæ elongate, even to 12 cm, 1 to 2 mm wide, sinuate to serrate, the abnormality simulating that common in *C. capillaris*.

Specimens: BOLIVIA, Herzog 2190a, isotypes in U. S. Nat. Herb. and Herb. Univ. Calif. Williams 1126, 1133; PERU, Bues 1010, 2179, MacBride 4522, Soukup 2356, Kanehira 185; ECUADOR, Steyermark 53380, 53475; COLOMBIA, Apolinaire Marie 15.

10. CTENOPTERIS GRAVEOLENS (Baker) Copeland, comb. nov.

Polypodium graveolens BAKER apud JENMAN, Jour. Bot. 15 (1877) 265.

"Eupolipodium . . . Stipes densely tufted, from a rather stout, fibrous caudex, $\frac{1}{2}$ – $1\frac{1}{2}$ inches long, slender, wiry, dark-brown, thinly clothed with soft spreading, rusty hair; fronds pendent or prostrate, 5–9 inches long, 1–2 $\frac{1}{2}$ inches wide, cut down to a narrowly-winged, filiform, dark-coloured, flexuose rachis, into unequal, patent, narrowly linear, bluntish, abruptly dilated, widely adnate, decurrent, sub-distant, pinnæ, which are $\frac{1}{2}$ – $1\frac{1}{2}$ inches long, 1– $1\frac{1}{2}$ lines wide; margin subentire or crenulate; midveins fine, flexuose, their branches very oblique, simple, or producing $\frac{1}{2}$ – $\frac{3}{8}$ from the bar a slight external branchlet; sori sub-distant in two contiguous rows, terminal on the vein-branches; surfaces naked; texture subcoriaceous; colour drying grayish; lower pinnæ more or less reduced. No. 73, Herb. Kew, 1877. Remarkable for the strong physicky smell emitted by fresh specimens."—Baker, l. c.

The rhizome is densely beset with coarse roots; stipes also densely fascicled, usually sparsely setose upward, always densely so at base, the hairs varying in color from slate to orange. The stipes reach a length of 6 cm, a diameter commonly of 0.4 mm; lamina up to 30 cm long. Sporangia naked. Above their bases, the pinnæ are separated by about their own width.

Specimens: JAMAICA, Jenman, *Maxon* 1280, 2661, 2670, 2710, 2744, 9710, 9747, 9879 (alt. 2,100 to 2,210), 10029, 10230. *Maxon & Killip* 1174, *Chute* 97, *Hart* 41, 1145, *Sherring* s. n., *Harris* 7317, *Watt* 175; HISPANIOLA, *Ekman* 12824.

11. *CTENOPTERIS NUBIGENA* (Maxon) Copeland, comb. nov.

Polypodium nubigenum MAXON, Cont. U. S. Nat. Herb. 17 (1916) 599.

"Plants usually epiphytic, the fronds pendent or prostrate, numerous, fasciculate, 10 to 25 cm. long. Rhizome erect or oblique, 1 to 3 cm long, about 4 to 7 mm. in diameter . . . densely but inconspicuously paleaceous, the scales dark glossy brown in mass, nearly acicular, 1.8 to 3 mm. long, 0.1 to 0.2 mm broad, subflexuose toward the tip, distantly erose-denticulate, sparingly long-ciliate . . . stipes 1 to 2 cm long, 0.3 to 0.4 mm. in diameter, densely pilose with long spreading reddish hairs; lamina very nearly pinnate, 9 to 23 cm long, 1 to 6 cm. broad, linear, acutish at both ends; rachis slender, blackish and raised below, bearing a few scattering but persistent stiffish hairs . . . also, together with both surfaces of the lamina throughout, copiously glandular-puberulent, the hairs minute, consisting of 2 to 4 spherical whitish bead-like cells; segments . . . spreading (averaging 70°), alternate, straight or subflexuose, 0.5 to 5 cm. long, 2 to 3 mm. broad, linear, usually attenuate and acutish, strongly sinuate, . . . the segments rather close, faintly connected, the sinuses narrow, acutish; . . . veins 3 to 18, pairs, very oblique (20 to 30°), simple (or the basal ones forked), slightly curved, extending halfway to the margin; sori 2 to 17 pairs, terminal, superficial, not confluent . . .; sporangia glabrous, the annulus usually 12-celled . . ." Spores globose.

"Type: Maxon no. 1477; summit of blue Mountain Peak, Jamaica."

Most closely related to *Polypodium graveolens* Baker, also in Jamaica, but at less altitude; but *Polypodium nubigenum* is distinguished by narrower paleæ, more slender stipes, pilose rachis, acutish sinuses, and mostly simple veins, etc.

Confined to Jamaica, and to major altitudes. Specimens: *Underwood* 1463, *Maxon* 1388, 1477 (type), 9846, 9878, 9878a, 9940, 10020, 10030, 10589, *Maxon & Killip* 1099, 1140, 1173, *Stoudt* 798, *Webster & Goldberg* 170, *Hatch* 29, *Johnson* s. n., *Orcutt* s. n.

After examination of these numerous specimens, I would amend Maxon's description, making the rhizome less bulky, emphasizing the density of the roots and of the hairs at the bases of the stipes, and, correlated therewith, smaller paleæ.

The decurrent pinnæ are so "faintly connected" that I would call the lamina pinnate. Although Maxon evidently entertained no doubt about the distinctness of his *Polypodium nubigenum* and *Polypodium graveolens*, they seem to me to be much alike.

12. **CTENOPTERIS TMESIPTERIS** (Maxon) Copeland, sp. nov.

Polypodium Tmesipteris MAXON in herb.

C. C. pseudocapillari similis, rhizomate breve erecto, paleis parvis (1–1.5 mm longis) lanceolatis setis albidis ciliatis vestito; stipitibus caespitosis, filiformibus, obscuris glabrescentibus, aut fere aut usque ad rhizoma alatis; lamina flacida, pendente, usque ad 40 cm longa (saepius minor); 5 cm lata, subpinnata, rhachi filiforme glabra nigrescente; pinnis erecto-patentibus, lineari-lanceolatis, 3 mm latis, obtusis, basi adnatis et decurrentibus, herbaceis, glabris; venis angulo 45° distantibus, simplicibus; soris terminalibus, medialibus; annulo 12–13-cellulare.

COSTA RICA, Cerro de las Vueltas, alt. 3,000 m on tree in wet forest, Standley 43755, type; *ibidem*, Standley & Valerio 43818.

Less extremely lax and less completely pinnate than *Ctenopteris pseudocapillaris*, and with broader pinnæ.

13. **CTENOPTERIS SUPRASCULPTA** (Christ) Copeland, comb. nov.

Polypodium suprasculptum CHRIST, Bull. Boiss. II 5 (1905) 3.

"Eupolypodium, rhizomate debile, brevi, frondibus fasciculatis (4) fere sessilibus 8–10 cm. longis 12 mm. latis, versus basin et versus apicem attenuatis pinnatis apice pinnatifidis, Rachi tenui flexuoso viridi-fusca, pinnis 16 ad 22 utroque latere racheos, falcatis, patentibus versus apicem ascendentibus, approximatis lanceolato-acuminatis 1 cm. longis basi late adnatis 3 mm. latis inaequalibus supra anguloso-auriculatis infra cuneatis, serratis. Nervis simplicibus obliquis 5 ad 6 utroque costae latere, in pagina superiore pinnarum prominentibus elevatis conspicuisque, in pagina inferiore haud elevatis, infra marginem sorum unum terminalem valde immersum punctiformem brunneum ferentibus. Textura firma, colore dilute virente, planta glaberrima, facie *Asplenii pulchellii* Radde."—Christ, l.c.

"Costa Rica; Volcan de Turrialba, alt. 2400 m, Werckle n. 14145."

Paleæ 1½ mm long, lanceolate, entire; fronds up to 40 cm long and 6 cm broad; pinnæ inciso-serrate with acute, spreading teeth; sporangia naked.

Specimens: COSTA RICA, Alfaro s. n., Brade 69, Maxon 395, 455, Maxon & Harvey 8174, 8445, Standley 39093, 39129, Standley & Valerio 50649, Valerio 290; PANAMA, Killip 5304, Maxon 5477, 5634.

14. *CTENOPTERIS SUBSESSILIS* (Baker) Copeland, comb. nov.*Polypodium subsessile* BAKER, Syn. Fil. (1867) 329.*Polypodium pendulum* var. *subsessile* BAKER, Fl. Bras. I² (1870) 514.*Polypodium pteropus* HOOKER, Sp. Fil. IV (1862) 192, Plate 275 B, non Blume.*Ctenopteris pteropus* J. Smith, Hist. Fil. (1875) 165.*Polypodium euchlorum* KUNZE: KLOTZSCH; HIERONYMUS, Engler's Jahrb. 34 (1904) 509, non Sodiro.*Polypodium chiricanum* MAXON, Cont. U. S. Nat. Herb. 17 (1916) 597, Plate 43.

"Caudex a small scaly rhizome densely rooting with copious fibers suberect, stipites terminal caespitose very short 2-4 lines often none (in other words the stipes is winged with dwarfed lobes or segments to its very base slightly hairy), fronds firm-membranaceous or even subcoriaceous erect 4-18 inches long 1-5 or more inches wide glabrous more or less opaque or subpelucid lanceolate acuminate singularly contracted and decurrent below deeply almost quite to the base pinnatifid rarely subpinnate, segments remote linear and often elongato-linear obtuse or subacuminate entire (not lobed or sinuated) their base broad and much decurrent when within a few inches of the stipes suddenly dwarfed much dilated above and below and forming shallow lobe-like wings reaching to the caudex, rachis and costule black, veins short oblique numerous each bearing a small slightly sunk oval or subrotund sorus rather nearer the costule than the margin."

"Hab. Mossy trunks of trees, Andes of Quito, alt. 3000-4000 feet, Jameson n. 348, Spruce n. 5712, and in Mount Abitagua, Spruce, Roraima, Venezuela, Schomburgk. New Grenada, Hartweg n. 1495."—Hooker, l. c.

Hooker's description and plate depict well the plant in full development. Other typical collections are *Rimbach* 74 and a *Lehmann* 6517, from Ecuador. Most collections believed to represent this species are smaller plants with segments less widely spaced. The paleæ are commonly 1 mm, rarely up to 3 mm long, attenuate, with black walls and sparse, pellucid marginal setæ. The veins vary in position from a 45° angle to almost horizontal, and fall short of the margin. The sori are infra-medial.

Specimens: COLOMBIA, *Killip* 35342, *Apolinaire & Arthur* 39, *Cuatrecasas, et al.* 12438, *Lehmann* 7384; PANAMA, *Goldman* 1967, *Pittier* 5630, *Williams* 918, *Cornman* 1222, 1294, *Killip* 5290, 5325, 5470; COSTA RICA, *Standley & Valerio* 50319, 51433, 51453, 52118, 52254, *Standley & Torres* 47796; VENEZUELA, *Cardona* 1116, *Steyermark* 60199. BRITISH GUIANA, *im Thurn* 375; PERU, *Bues* 2179; BOLIVIA, *Buchtien* 2753, 2755, 5356, *Rusby* 379, 280, *Bang* 557.

Ctenopteris subsessilis is a variable species, from which I can not distinguish *Polypodium chiricanum*. The type of that species has the paleæ "lanceolate to ovate, . . . acute to attenuate." No other specimen has the paleæ quite so broad, but they intergrade from the ovate form to the narrowly lanceolate.

15. CTENOPTERIS MYRIOPHYLLA (Mettenius) Copeland, comb. nov.

Polypodium myriophyllum METTENIUS, Fil. Lechler. I (1856) 6.

Polypodium tenuisectum HOOKER, 2nd. Cent. (1861), Plate 21, non Blume.

"Caudice 'repente sublignoso,' stipitibus solitariis erectis flexuosis pilis setisve ferrugineis patentibus hispidissimis, frondibus digitalibus ad dorantalem lato-lanceolatis acuminatis rigido-subcoriaceis sparse setaceo-pilosis, pinnis primariis remotiusculis 2-pollicaribus lineari-acuminatis patentibus, pinnulis $1\frac{1}{2}$ lineam longis sessilibus linearibus acutiusculis integerrimis inferne subdecurrentibus univeniis, venis dimidia pinnarum latitudine apice, clavatis, soris solitariis globosis ad basin venarum insertis, rachi compressa."

" . . . Trunks of trees, near Tatanara, Peru, Lechler."

"I possess, indeed, only Peruvian specimens."—Hooker, l.c.

Specimens in the U. S. Nat. Herb. are: BOLIVIA, Tate 346; PERU, Bues 721, 1539, 1554, 2132, 2191; ECUADOR, Wiggins 10498.

16. CTENOPTERIS HETEROMORPHA (Hooker & Grev.) Copeland, comb. nov.

Polypodium heteromorphum HOOKER & GREV., Icones Fil. I (1829) Plate 108; HOOKER, Sp. Fil. IV 229.

Arthropteris heteromorpha J. SMITH, Hist. Fil. (1875) 235.

Polypodium variabile METTENIUS apud KUHN, Linnaea 36 (1869) 133.

Polypodium dependens BAKER, Syn. Fil. (1867) 335.

"Simplex vel ramosum, hirsutum, pinnatum; pinnis breviter petiolatis ovalibus subintegris vel oblongis pinnatifidis, soris in singula vena solitariis."

"Hab. In rupibus humidis prope verticem montis Pichinchae, Andium Peruvianarum. D. Prof. Gul. Jameson."

"Planta valde polymorpha, ubique hirsuta."

"Stipes ut et rachis, filiformis, hirsutus."

"Frons, circumspectione, linearis, palmaris et spithamean, nunc simplex, flexuosa, nunc bis terve dichotoma, ramis pinnatis, pinnis remotiusculis semiunciam fere ad unciam longis, brevissime petiolatis, ovalibus, et tunc marginibus integris vel subintegris, vel oblongis pinnatifidis vel sinuato-pinnatifidis, lobis obtusissimis, ubique hirsutis, pilis longis versus basin ramosis, nunc stellatim divis. Color fusco-viridis."

"Sori in singula vena solitarii, rotundati."

"Capsulae annulo fere completo cinctae, pedicellatae."

"Semina subtriangularia flavescenti-fusca."—Hook. et Grev., l. c.

"Veins simple, rather distant, manifest."—Hooker, l.c.

Extremely variable, in form, in degree and manner of dissection, and otherwise. The frond develops in three forms, and in intermediates between the three.

The simplest, and surely the most primitive frond-form is the simply pinnate. This is *Polypodium dependens*, described from Ecuador, where it seems to be less common than the more dissected forms. The type of *Polypodium dependens* is Spruce 5637, from Pichincha, also the type locality of *Polypodium heteromorphum*. It is exactly matched by two plants of Mille 6, from the same locality, which collection contains also fronds of a different form, with long, large pinnæ. This simply pinnate form occurs in Peru, Bues 731, 975; and in Bolivia, Buch-tien 2195, 2752.

Most Mexican collections are simply pinnate,—Sanchez 364, Purpus 1596, Matuda 2890, Lyonnet 232, 1395, 1479, Moore & Wood 4526, Liebmann 2508, Pringle 4145b; but occasional forked fronds are found in many collections. All Mexican collections are narrowly linear, and they may be very long and long-attenuate; one frond of Lyonnet 1479 is more than 80 cm long by 8 mm wide.

Guatemala specimens,—Pittier 24, Steyermark 36134,—are dichotomous.

Most Ecuador specimens are dichotomous, one to 4 times,—Mille 9, Couthouy s. n., Anthony 282, Little & Paredes 6837, Fermin 1576, Rimbach 76, Sodiro s. n., Stuebel F 30. Some Colombia specimens are dichotomous,—Hartweg 1517, Lehmann 4488, Pittier 1670.

Bipinnate, or in part tripinnate forms are rare in Ecuador, whence they were described as *Polypodium variabile* Mett. An unnumbered collection by Mille is of this form. It may be commoner in Colombia, whence we have Pennell 9934, Pennell & Hazen 10071. This bipinnate form prevails in Peru, represented by Bues 1393, 1555, 1606, 2071, 2164, 2165, 2166, 2167,—8 collections, so different that it would be easy to construe them as representing several species.

Rhizome short, more or less erect, paleæ 1 to 2 mm long, fuscous, ciliate; stipes 1 to 5 cm long, finely filiform, brown, bearing few fine hairs, glabrescent, wherefore the paleae are evident; rachis sparsely villose; pinnæ (the ultimate leaflets) sessile, or somewhat adnate, or short-stalked (as described), 2 to 8 (–18) mm long, rounded at apex, oblong, or obliquely

ovate, or orbicular, sparsely to very densely hirsute, herbaceous; sori medial, sporangia bearing few long hairs. A fern of major altitudes, up to at least 4,000 m.

One of the most variable of ferns, easily the most so of *Ctenopteris*. It would be easy to describe as distinct not merely the three salient forms described and listed above and already named, but others, intermediate or characterized by form of pinnæ or by pubescence. But if that course were adopted it would not be easy to limit the resultant number of species.

17. *CTENOPTERIS PODOCARPA* (Maxon) Copeland, comb. nov.

Polypodium podocarpum MAXON, Smith's Misc. Coll. 56²⁴ (1911) 2.

Rhizome woody, ascending to erect, paleæ dark, small, entire; stipes fascicled, 1 to 5 cm long, stout, beset near the base with brown hairs 2 mm long; frond up to 45 cm long, 15 to 20 cm wide at and above the middle, pinnatifid to a broad wing, rather abruptly contracted downward to a wing which may extend almost to the rhizome, subcoriaceous, light-green, glabrous except for dark amorphous squamules; segments linear, 8 up to even 20 cm long, usually simple but sometimes forked more than once, regularly toothed on both sides, 8 mm wide over the teeth, the uncut body about 5 mm wide; veins simple or forked, a simple vein or the long across-copic branch entering each tooth and there bearing a conspicuous sorus.

PANAMAS Chirique, above Boquete, alt. 1,650 to 1,925 m; Maxon 5640 (type), Maxon 5656, Killip 5324.

Evidently related to *Ctenopteris capillaris*. Well distinguished by the uniform soriferous teeth. The Killip specimen has comparatively uniform segments.

GROUP OF *CTENOPTERIS ELASTICA*

Key to the species

Pinnæ at most 2.5 mm wide.

Pinnæ decurrent-confluent.

- | | |
|--------------------------|--------------------------|
| Stipe glabrescent | 1. <i>C. dissimulans</i> |
| Stipe finely hairy | 2. <i>C. Chaseæ</i> |

Pinnæ not decurrent.

Stipes glabrescent.

- | | |
|------------------------------|----------------------------|
| Frond viscid-pubescent | 3. <i>C. jamesonioides</i> |
| Frond glabrous | 4. <i>C. Glaziovii</i> |

Stipes and fronds pubescent.

- | | |
|----------------------------------|------------------------|
| Lime-dots on upper surface | 8. <i>C. Turrialbæ</i> |
| Lime-dots wanting. | |

- Frond pinnatifid 7. *C. Knightii*
 Frond pinnate.
 Apex long-caudate 5. *C. apiculata*
 Apical cauda not long.
 Paleæ ciliate 9. *C. lanigera*
 Paleæ entire.
 Costæ black 6. *C. aromatica*
 Costæ not black 10. *C. leptostoma*
 Pinnæ wider, at least near base.
 Fronds subcoriaceous 11. *C. rigens*
 Fronds herbaceous.
 Fronds narrowly linear.
 Fronds up to 45 cm long 12. *C. mollissima*
 Fronds 55 cm long 13. *C. alsophilicola*
 Fronds broader.
 Ciliate, hairs partly clustered 14. *C. reclinata*
 Hairs simple.
 Sori oblong 15. *C. xanthotricha*
 Sori round.
 Pinnæ dwindling to extreme tip.... 16. *C. Rhizophoræ*
 Cauda more or less entire.
 Segments about 3 mm wide..... 17. *C. ciliaris*
 Segments 5 mm wide at base.... 18. *C. elastica*

1. **CTENOPTERIS DISSIMULANS** (Maxon) Copeland, comb. nov.

Polypodium dissimulans MAXON, Cont. U. S. Nat. Herb. 10 (1908) 502.

"A very delicate pendent plant with numerous flaccid linear fronds; rhizome erect, minute, slender 1 to 1.5 mm. in diameter, bearing a few relatively large bright brown lanceolate scales, with dark cell walls; fronds 15 to 20 cm. long, 9 to 12 mm broad, scarcely stipitate, greatly reduced below, the rachis filiform, dark brown or blackish, bearing 45 to 60 pairs of distant narrow alternate pinnæ, decreasing gradually toward the apex or sometimes abruptly to a narrow terminal caudate segment 2 cm. long, 2 mm. broad at the base and there coarsely lobed; pinnæ separated once or twice their width, adnate, smooth, membranous, translucent, the lowermost minute, decurrent, distant less than 1' cm. from the rhizome, those immediately above gradually larger and with simple midveins; characteristic pinnæ 6 mm. long, 1.75 mm. broad above the base, strongly decurrent, lanceolate, straight or recurved, borne obliquely (usually at an angle of about 45°), margins with a few shallow dentate serrations, apex somewhat produced, subentire, obtuse, midveins dark, flexuose, with about 4 or 5 pairs of oblique alternate veins extending half way to the margin and corresponding to the oblique marginal teeth; sori large, slightly impressed, confluent with age, terminal upon the veins."

Type, coll. v. *Tuerckheim*, near Coban, Alta Verapaz, Guatemala, distributed by J. Donnell Smith No. 844, as *Polypodium jubæforme*.

Distinguished from *Polypodium jubæforme* by delicate texture, almost superficial sori, and toothed pinnæ.

Other specimens, from Guatemala: *Johnson 678*, *Standley 71160*. Toothed margin without veins entering the teeth are a peculiarity of *Ctenopteris dissimulans*.

2. *CTENOPTERIS CHASEÆ* Copeland, sp. nov.

Plate 5.

C. rhizomate parvo, paleis ferrugineis 2–3 mm longis, ciliatis vestito; stipite 1 cm longo, deorsum dense piloso; lamina 10 cm longa, 1.6 cm lata, glabra, herbacea, præcipue deorsum attenuata, pinnatifida; segmentis erecto-patentibus, 1 cm longis, 1.6 mm latis, obtusis, decurrentibus, sinuatis; venis simplicibus, perobliquis; soris medialibus, sporangiis nudis.

BRAZIL: Serro do Caparao, Espiritu Santo, alt. 2,100 m; 1. *Agnes Chase*. also, PERU, Dept. Junin, *Schunke A 153*.

3. *CTENOPTERIS JAMESONIOIDES* (Fée) Copeland, comb. nov.

Polypodium jamesonioides FÉE, 7 Mém. (1857) 59, Plate 21, fig. 4.

Polypodium azuayense SODIRO, Crypt. Vasc. Quit. (1893) 323.

"Fondibus linearibus, multipartitis, fasciculatis, viscosis, glabriusculis, evolutione apicis indefinita; petiolo brevi filiforme; segmentis oblongis, basi ad apicem decrescentibus, obtusis, opacis; sporotheciis 6–8, crassis, confluentibus, laminam integre tectantibus; sporangiis subrotundis; pedicello lato; annulo 14 articulado; sporis polymorphis; surculo tenui, erecto."

"Habitat in Novo-Granatensi; provincia Ocaña; L. Schlim, no. 399."

"Filix debilis, pendula, angusta; evolutione indefinita Jamesoniae."—Fée, l. c.

The type of *Polypodium azuayense* was from Prov. Azuay, near Quinoas. The U. S. Nat. Herb. has a specimen from Tungurahua, collected by Sodiro. Other collections: PERU, Valley of Rio Calca, alt. 11,000 ft, *Bucs 1805*. COSTA RICA, *Standley & Valerio 43737, 43917*. HAITI, *Ekman H7791, H10635*.

Sporangia glabrous; annulus of 14 cells; spores tetrahedral. The identity of *Polypodium azuayense* is suggested by Morton in herb.

4. *CTENOPTERIS GLAZIOVII* (Baker) Copeland, comb. nov.

Polypodium glaziovii BAKER, Ann. Bot. 5 (1891) 465.

"Rhizome short-creeping; paleae dense, linear light-brown. Stipes 1–3 in. long, densely covered with fine spreading brown hairs. Frond lanceolate, subcoriaceous, glabrous, 8–10 in. long, 1½–1¾ in. broad at the mid-

dle, narrowed very gradually to the base, cut down nearly to the rachis into linear entire lobes, the largest $\frac{1}{2}$ – $\frac{3}{4}$ in. long, $\frac{1}{8}$ in. broad. Veins 12–15-jugate, distinct, once forked, falling short of the margin. Sori small, superficial, medial. South Brazil, *Glaziou 9062*. Near *Polypodium inaequale*—Fée.

I find the veins simple; the spore tetrahedral, the stipes glabrescent.

Specimens: *Glaziou 2070*, Rose. Fil. austrobras. *Wacket 108*, *Annies, 108a*, *Mulford & Racine Foster 689*, *Mejia 4272, 5105*, all from Brazil. Misfit description-hairy costa, simple veins. *Schmalz 160a*, Sta. Catharina; *Wacket 288*, S. Paulo—*Polypodium Rosenstockii* Maxon.

5. CTENOPTERIS APICULATA (Kunze.) Copeland, comb. nov.

Polypodium apiculatum KUNZE apud KLOTZSCH, *Linnaea* 20 (1847) 378.

"Rhizomate erecto, plus minusve elongato, paleis lanceolato-acuminatis, hispidis, sordide fuscis oblecto; frondibus profunde pinnatifidis pinnatisve, lanceolatis, suboblongis, acuminatis, longe stipitatis; rhachi stipiteque sordide fusca, dense hispidula; laciniis lanceolato-linearibus, erecto-patentibus, alternis, obtusiusculis, multisoris, utrinque glabris; pinna terminali integerrima, lineari, obtusa; venis pinnatim ramosis; soris pallide-fuscis, parvis, alternis; stipite elato."

"Lamina frondis oblongata, pinna terminali elongata integerrima instructa, 4–6 poll. longa, pollicem ad sesquipollicem lata. Lacinae remotae versus basin magis distantes, 6–9 lin. longae, 1–1 $\frac{1}{2}$ lin. latae. Stipes tenuis, hispidus, 1–1 $\frac{1}{2}$ pollices longus."

"Guiana angl. Richard Schomburgk n. 1213. In Colombiae Colonia Tovar ad truncos arborum. Moritz, p. 247."—Kunze, l. c.

Named in appreciation of the caudate apex up to 3 cm long, hardly more than 1 mm broad. Paleae about 2 mm long, dark, short-ciliate with pale setulae; stipes 4 to 5 cm long; lamina herbaceous, commonly 10 cm, rarely 20 cm long, 2 to 5 cm broad, cut to the rachis and therefore pinnate but without wingless space on the rachis, base rounded with 1 or 2 shortened pinnae, or truncate; veins short, simple; sori terminal on veins, medial between costa and margin, superficial or subimpressed, sporangia naked, annulus of about 12 cells, spores tetrahedral, dark.

Specimens: HISPANIOLA, *EKMAN 11828, 12822, Seifrig 17*; COSTA RICA, *Pittier 12007, 12146, Skutch 2163, 4361, Standley & Torres 47832*; COLUMBIA, *Lehmann 734, 1040, 1049, 4499, Woronow 7119, Amortegui 352, Killip 38435*; VENEZUELA, *Moritz 247* (second citation in original description), *Fendler 218* (det. Mettenius, cited by Hooker, Sp. Fil. IV 185); PERU, *Bues 1252*; BRAZIL, *Leite 3611, Brade 9774, 18363*.

According to Hieronymus, Bot. Jahrb. 34 (1904) 414, and Christensen, Index 551, *Polypodium pecten* Fée, Genera 240, described from Colombia, is a synonym of *Polypodium apiculatum*. I have not seen a specimen. The discrepancies in description are minor.

By the same authorities, *Polypodium confluens* Fée, Crypt. Vasc. Bras. I (1869) 89, Plate 26, fig. 3, is also a synonym. Its type is *Glaziou 2415*. In this case, I doubt the identity; but Fée's name is untenable.

6. CTENOPTERIS AROMATICA (Maxon) Copeland, comb. nov.

Polypodium aromaticum MAXON, Proc. U. S. Nat. Mus 27 (1904) 743; Proc. Biol. Soc. Wash. 52 (1939) 119.

Polypodium firmum KLOTZSH, Linnaea 20 (1847) 378, non Kaulf.-nomen.

Ctenopteris firma J. SMITH, Hist. Fil. (1875) 184.

Polypodium Herzogii ROSENSTOCK, Fedde's Repert. 6 (1908) 176.

"Plant rigid, 15-20 cm. high; rhizome stout, suberect, considerably elongate, with abundant dark-brown lanceolate attenuate chaff, and bearing numerous closely set fronds . . .; stipes averaging 3 cm long, dull-brownish, hispid by scattering short spinescent hairs which from their fragility early impart a tuberculate appearance; laminae pinnate, about 13-17 cm. long, at most 4 cm. broad, erect, coriaceous, opaque, narrowly oblanceolate, giving rise rather abruptly to a terminal caudate segment 2-3 cm. long . . . rachis hispid on both surfaces . . . pinnae about 35 pairs, distinctly alternate, linear strongly revolute, 2-2½ mm. broad, nearly or quite their width apart, entire, falcate . . . adnate . . . the lower pinnae gradually reduced, the lowermost not minute . . . the distinctly black midveins bearing 8-13 pairs of obscure simple oblique veins which approach the margin; sori 6-12 pairs to the pinna, borne at half the distance to the margin."

"Blue Mountain Peak, Jamaica; alt. 1950-2255 meters . . . Underwood n. 1449."—Maxon (1904).

Rhizome ascending, more or less elongate, paleæ 3-5 mm long, lanceolate, attenuate, entire, castaneous, firm; lamina broadest above middle, caudate, truncate at base; pinnae 2-4 mm wide, dilated at base but not confluent; sori medial or inframedial, sporangia naked. Pedicel one row of cells spores globose-tetrahedral.

Specimens: JAMAICA, Maxon 1346a, 9185, 9958; GUATEMALA, Hatch & Wilson 250, Johnson 535 a; COSTA RICA, Smith 4209; COLOMBIA, Killip & Smith 15847, Pennell & Hazen 10078; VENEZUELA, Pittier 201; Roraima Exped. 176; PERU, Bues 877, 976, 1394, 1548, 1565, 1807, 1818, 1820, 1867; BOLIVIA, Herzog

783 (type coll. of *Pol. Herzogii*), *Buchtien* 5254, *Bang* 901. Cited from Chile (type of *Polypodium firmum* Kl.). Peru specimens tend to have long stipes and narrow pinnæ.

7. *CTENOPTERIS KNIGHTII* Copeland, sp. nov.

Plate 6.

C. rhizomate parvo, paleis integris lanceolatis 3 mm longis vestito; stipitibus fasciculatis, filiformibus, 2-4 cm longis, setis 1.5 mm longis vestitis; lamina 10 cm longa, 1.2 mm lata, apice acuta, basi truncata, herbacea, fere ad rhachin pinnatifida, rhachi sparse setulosa; segmentis 3-4 latis, ciliatis, utraque facie sparsissime setosa apice rotundatis; venis simplicibus; soris medialibus, superficialibus, sporangiis nudis.

COSTA RICA, Las Nubes to La Palma, 1. *Wm. Knight* 29359 (type) also, Volcan de Poás, alt. 2,500 to 2,640 m, *Standley* 34907.

8. *CTENOPTERIS TURRIALBAE* (Christ) Copeland, comb. nov.

Polypodium Turrialbæ CHRIST, Bull. Soc. Bot. Belg. 35 (1896) 226.

"*Eupolypodium*. Stipitibus e rhizomate brevi debili confertis, numerosis, 2 ad 3 cent. longis, tenuibus, atratis pendulis, pilis longis cum rachi tota vestitis, frondibus minoribus pinnatis lanceolatis, majoribus bipinnatis, latissime ovatis. Frondibus 2 dec. longis medio latissimis 10 cent. latis versus apicem et basin valde attenuatis, leviter sed tenuiter herbaceo-membranosis dilute viridibus longe ciliato-pubescentibus subdiaphanis. Pinnis ad rachim usque incisissimis infimis liberis caeteris basi sese tangentibus, omnibus adnatis e basi latissima versus apicem sensim attenuatis apice obtusiusculis margine integris, in frondibus minoribus simpliciter pinnatis late linearibus (2 cent. long. $\frac{1}{2}$ cent. lat.) in media parte frondium majorum valde elongatis 6 cent. longis a medio usque ad apicem dilatatis (2 $\frac{1}{2}$ cent. latis) et dense pinnatis, pinnulis lanceolatis numerosis (usque ad 12 quoque latere.) Nervulis simplicibus in maculam soriferam terminantibus marginem non tangentibus. Soris secus nervum pinnae seu pinnulae uniseriatis, magnis, ochraceis, rotundis, paginam inferiorem implentibus.—Troncs d'arbes au pied du volcan de Turrialba, 2750 m., 26 janv. 1889; parait rarissime (Pitt. no. 847.)"—Christ, l. c.

Rhizome small, erect; stipes densely fascicled and setose, paleæ therefore invisible or wanting; lamina 20 to 50 cm long, 4 cm wide, short-attenuate to both ends, pinnate; pinnæ 3 mm wide, short-decurrent, semiadnate on the upper side, obtuse, setose on both surfaces, hairs fine, 0.7 to 1.0 mm long, herbaceous; veins simple, hardly visible; sori medial or infra-medial, marked by lime-dots on the upper surface, sporangia naked.

This description differs too widely from Christ's, as Maxon has noted on his isotypic fragment. Christ, *Farnkr. der Erde* (1897) 81, cites this species as teratological. The numerous

sheets in U. S. National Herbarium, and the photograph of the isotype in the Costa Rican Herbarium, are one species, and by these I interpret it.

Specimens: COSTA RICA, Maxon & Harvey 7874, 8442, Standley & Valerio 48083, 49704, 50322, 50356, 50469, 51626, 51628, Standley 33036, 33076, 35299, 38538, Valerio 49, 2357, Skutch 3421, Chrysler 5040.

9. CTENOPTERIS LANIGERA (Desvaux) Copeland, comb. nov.

Polypodium lanigerum DESVAUX, Berlin Mag. 5 (1811) 316, not seen; Jour. Bot. 6 (1814) 263; METTENIUS, *Polypodium* 48, No. 49. *Polypodium laxum* PRESL, Rel. Haenk. (1825) 23, Plate 4, fig. 1; HIERONYMUS, Bot. Jahrb. 34: 508, at least in part.

Rhizome short and stout, typically paleate with ciliate and setose paleæ 1 to 1.5 mm long, but paleae subject to suppression if the stipes are particularly densely caespitose and hairy at base; stipes 1 to 3 cm long, caespitose and more or less densely hairy at base, subglabrescent upward, wiry; lamina 30 to 45 cm long, linear-lanceolate or linear, attenuate to both ends, rachis and surfaces pilose; pinnæ entire, acute to obtuse, adnate, not confluent, few lowest pinnæ remote, reduced to vestiges; veins simple; sori medial or nearer to margin, superficial, sporangia variously setulose.

As to what is real *Polypodium lanigerum*, we have a photograph of the type, which has rather narrowly linear fronds. We have also a note signed by Weatherby on U. S. Nat. Herb. sheet No. 1196914, distributed by Sodiro without number as *Polypodium alternifolium* Hooker: "This is like the type of *Polypodium lanigerum* Desv." The same statement is published in Gray Herb. Cont. 114 (1936) 32, except that the specimen is said to have been distributed as *Polypodium dependens*. Identical with this specimen is an unnumbered collection by Sodiro in Herb. Univ. Calif., No. 678687, distributed as *Polypodium alternifolium*.

Weatherby states that the sporangia are naked; and, because Mettenius, *Polypodium* 48, No. 49, says "Sporangia hinc inde seta singula instructa," Weatherby concludes that "It seems, therefore, doubtful if Mettenius interpreted the species correctly." But, in an annotation on the same Sodiro sheet, Maxon says "One in ten specimens bears a long seta," thus agreeing with Mettenius. And, still examining the same sheet, I have found, rarely, plural as well as singular setæ.

The conclusion is that competent observers have found the sporangia of *Polypodium lanigerum* naked and sparsely setose, and that there is no reason for supposing that Mettenius misconstrued the species.

The reduction of *Polypodium laxum* to *Polypodium lanigerum* was by Presl himself, Tent. 178. He was followed by Mettenius, and by Hooker, Sp. Fil. IV 189. Hieronymus, Bot. Jahrb. 34: 508, disagreed,—“*P. lanigerum* Desv. . . ist Species optime distinguenda, differt enim a *Polypodium laxo* Presl pinnis remotis erecto-patentibus e lata basi oblique elongato-deltaideis densius villosa.” His only citation of *Polypodium laxum* is Bang 483, from Bolivia. This seems to me properly to represent *Polypodium laxum*, but to be *Polypodium lanigerum* also. Similar collections are Bues 2130 and Kanehira 122 from Peru, Rimbach 68 from Ecuador, and Cuatrecasas 13089 from Colombia.

Nobody has mentioned the paleæ of *Polypodium laxum* or *Polypodium lanigerum*. The explanation is obvious,—they are more or less completely suppressed. If recognizable at all, they are ciliate and setulose.

10. CTENOPTERIS LEPTOSTOMA (Fée) Copeland, comb. nov.

Polypodium leptostomum FÉE, 7 Mém. (1857) 58, Plate 21, fig. 2.

“Frondibus anguste lanceolatis; petiolo brevi, fusco, pilis capitatis (an viscosis?) vestito, rachi ejusdem colore, sed pilis acutis cooperto; segmentis lineari-lanceolatis, glabris, acutis, rigidis, erectis; mesoneuro apice vix flexuoso; nervillis lateralibus simplicibus, brevibus; sporotheciis laxis, 5–7 centralibus; sporangiis rotundis; annulo 12 articulado; stomate prominulo; sporis ovoideis; surculo erecto, duro, radículas fuscas longissimas ferente.”

“Habitat in Mexico, prope Orizabam ad arbores; W. Schaffner, no. 210.”

“Felix tenera, pectinata, flexilis; surculo tenui.”

French description says segments are 40 to 50 pairs; fronds numerous, fascicled.

Polypodium productum MAXON, Cont. U. S. Nat. Herb. 13 (1909) 11, non Christ, 1907.

Fée's description is inadequate, Maxon's very detailed. Items are: paleæ iridescent, lanceolate, attenuate, entire, 3 to 3.5 mm long, slender, fragile; stipe 2 to 3.5 cm long, hispid with unequal short brownish hairs; lamina arcuate or recurved, membranaceous-coriaceous, margin slightly recurved, pinnate, long-attenuate to apex, pinnæ obtuse, glabrous; veins about 6 pairs, simple; sporangia naked.

One frond of the type of *Polypodium productum* is 30 cm long, 11 mm broad, most of them are shorter and broader; pinnæ

separated by less than their own width; sori medial, terminal on veins, superficial.

I have not seen authentic *Ctenopteris leptostomum*. Of *Polypodium productum*, the type, v. *Tuerckheim* 1347, 53 partim; also *Johnson* 535b, *Hatch & Wilson* 259, all from Guatemala, near Coban.

11. **CTENOPTERIS RIGENS** (Maxon) Copeland, comb. nov.

Polypodium rigens MAXON, Proc. U. S. Nat. Mus. 27 (1904) 741.

Polypodium domingense BRAUSE, Urban, Symb. Ant. VII (1911) 159, non Spr.

Polypodium regescens JENMAN, Bull. Bot. Dept. Jamaica 4 (1897) 117, non Bory.

"Plant 15-28 cm. high, with 10-15 slender rigid fronds; rhizome about 4 mm. thick, elongate, short-creeping or ascending, the grayish inconspicuous chaff noticeably iridescent under a lens, narrow, long-acuminate; stipes 2-4.5 cm. long, rigid . . . dark brownish, thickly covered with long spreading bright-brown hairs; laminæ 13-23.5 cm. long, 1-2 cm. broad, linear or linear-lanceolate, tapering from near the middle to both apex and base, dark-green above, conspicuously lighter on the under surface, coriaceous, opaque, cut to the blackish rachis into 45-60 pairs of alternate approximate pinnae; pinnae exactly oblong, regularly rounded at the apices . . . 10 mm. by 3.5 mm, decreasing in size very gradually above . . . the lowermost pinnae minute (2 mm.) . . . sori borne midway to the margins (4-6 pairs to each pinna) on the obscure free simple veins, the sporangia mixed with a few bright-brown hairs, similar hairs borne rather abundantly on both sides of the rachis but sparingly along the midveins and sterile veins on the under surface . . ."—Maxon, l. c.

JAMAICA, John Crow Peak, alt. 1,650 to 1,800 m.

The paleæ are copious, varying from gray to very dark, sometimes iridescent, 2 to 4 mm long, narrowly lanceolate, entire: laminæ remarkably long-attenuate, especially upward, finally ending in an entire or serrate tail.

Specimens: JAMAICA, Maxon 1346 (type) 1260, 1294, 2625, 2708, 9640, Maxon & Killip 658, 1157, Clute 111, Hart s. n. and 151, Bot. Dept. Jamaica 196. CUBA, Morton & Acuña 3503, 3505, 3545, 4509, Clement 1404: SANTO DOMINGO, Fuertes 1757, 1967 b, Ekman H 12823, Leonard 4687. GUATEMALA, Tuerckheim 53, Hatch & Wilson 240, Barber 200. COSTA RICA, Valerio 274. PANAMA, Maxon 5341; VENEZUELA, Pittier 13813; COLOMBIA, Killip & Valerio 34683; PERU, Bues 811.

Several of these collections were distributed as *Polypodium pilosissimum*, which, as known to me by a frond of the type collection, seems to be distinguishable by much longer, black marginal and superficial setæ.

12. *CTENOPTERIS MOLLISSIMA* (Fée) Copeland, comb. nov.

Polypodium mollissimum FÉE, 11 Mém. (1866) 47, Plate 12, fig. 2;
BAKER, Syn. Fil. (1874) 329; MAXON, Pterid. Porto Rico (1826)
411.

"Rhizome erect, 3-8 mm. long, 2-3 mm. thick, non-paleaceous, densely rusty-pilose. Fronds several or numerous, closely cespitose, pendent, 10-45 cm. long, the short blackish stipe (0.5-2 cm.) densely rusty-pilose at base, the hairs spreading or retrorse, fewer and paler upward; blades pinnatisect throughout, narrowly linear, 0.7-2.5 cm. broad, acutish at apex, attenuate at base, the lower segments (several pairs) gradually reduced, broadly triangular-dilatate, short, the lowermost minute and winglike; rachis slender, blackish, elevated beneath, rusty-pilose; segments close, alternate, horizontal, mostly ovate-oblong, roundish at apex, adnate and sometimes decurrent, or decurved above and below, entire or lightly crenate-undulate, membranous, translucent, laxly hirsute above, glutinous-glandular and closely hirtellous beneath, the margins castaneous-setose; costae concealed, flexuous; veins 3-6 pairs, simple, short, spreading; sori 1-4 pairs, terminal, borne mostly in the apical half of the segment; sporangia whitish-setose."—Maxon, l. c.

Specimens: GUADALUPE, U. S. Nat. Herb. No. 523531, 1. *Hermينية* (type fragment); Duss 4106, 4107; St. Kitts, Britton & Cowell 505, Box 291; DOMINICA, Haweis 27, Hodge & Hodge 3442 partim. PORTO RICO, Blauener 262, Jimenes 1799, Shafer 3583, Dale 12, Chase 6729, Hess 245, Sargent A15. HAITI, Abbot 1963, 2095, Leonard & Leonard 14564, Valeur 408. CUBA, Wright 1018, Maxon 4333, Shafer 3433, Pollard & Palmer 180, Hioram 7050, Clement 4632. JAMAICA, Maxon 1534, 1802, 2273, 8846, 8861, 9028, 9063, Wilson s. n. GUATEMALA, v. Tuerckheim 3878, 8056, 8366, Maxon & Hay 3122, 3199, Johnson 372; COSTA RICA, Standley 38116, 38138, Skutch 2411. PANAMA, Seemann s. n., Seaverns 52, Pittier 4479. TRINIDAD, Hombersley 212; SURINAM, Maguire 24498, 24762.

The most distinctive feature of *Ctenopteris mollissima* is the suppression of the paleæ, under the combined influence of countless roots and dense hairs at the bases of the stipes. A specimen from Ecuador, Sodiro 158, reasonably referable to this species, has some minute paleæ.

13. *CTENOPTERIS ALSOPHILICOLA* (Christ) Copeland, comb. nov.

Polypodium alsophilicolum CHRIST, Bull. Soc. Bot. Genève II 1
(1909) 219.

"Rhizoma brevi polycephalo setis rufis tecto, foliis numerosissimis fere fasciculatis dependentibus exarticulatis, stipite tenui filiformi 4 mm. longo cum rachi setis purpureis patentibus 2 mm. longis abunde vestito, lamina

65 cm. longa 16 mm. lata loriformi, basi propter pinnae infimas reductas angustata, acuminata, usque ad rachim pinnata sed pinnis late adnatis nec liberis, pinnis confertis angulo obtuso separatis ca. 180 utrinque, trigono-oblongis obtusis 11 mm. longis basi 5 mm. latis. Costa flexuosa, nervis utrinque 4 aut 5 obliquis, simplicibus, vix marginem attingentibus non clavatis, soris ca. 4 rarius 5 utrinque, medialibus, ochraceo-fulvis $\frac{1}{2}$ mm. latis.

"Facies abunde pilis rufis patentibus tectis et ciliatis.

"Colore brunneo-viridi, textura tenuiter herbacea.

"Habitum Lycopodii cujusdam epiphytica.

"Hab. Vallee du Copal, Costa Rica merid. 'Croît exclusivement sur les tiges d'Alsophila' 1. H. Pittier, 15. 3. 1897. No. 10971."—Christ, l.c.

Known only by the type collection, of which two sheets are in the U. S. Nat. Herb.

Annulus, 13 cells; spores globose-tetrahedral.

Very near to *Ctenopteris elastica*, from which it is distinguished by fronds twice as long and narrowly linear, and by more crowded pinnæ.

14. *CTENOPTERIS RECLINATA* (Brack.) Copeland, comb. nov.

Polypodium reclinatum BRACK., U. S. Expl. Exped. XVI (1854) 11.

Polypodium cultratum var. *reclinatum*, of various writers.

Rhizome short, ascending, paleæ 1 to 1.5 mm long, ferruginous, ciliate; stipe short, commonly 1 cm long, slender, setose with tawny hairs; lamina of type 25 by 2.2 cm, commonly larger, 30 or 40 cm long and 2.5 to 3.0 cm broad, short-attenuate to both ends, pinnate, rachis black, slender, pilose; pinnæ ovate-oblong, 5 mm wide, broadly rounded at apex, base half-adnate on the acroscopic side, short-decurrent but not nearly to the next-lower pinna, finely pubescent on the surface ciliate with partly clustered setæ usually 2 to 3 mm (rarely up to 4 mm) long, thinly herbaceous; veins simple, sori terminal on veins, medial or slightly nearer the margin, in rows of up to six, not crowded; sporangia setulose with hairs varying in number and length.

Type: *Wilkes Exped. 161*, from Organ Mountains, near Rio, in U. S. Nat. Herb. Ten other collections, all from the same region, uniform in appearance, reasonably so in detail; *Riedel* (coll. in 1822; marginal setæ up to 4 mm long; sporangia densely beset with long setulæ); *Glaziov 2417* (setulæ 1.5 times diameter of sporangium, which is usual); *Dusen 3723, 6525, Wacket, Rosenstock, Fil. austro-bras. exsicc. 102, L. B. Smith 1762, 1835, Luis 729, Brade 8316, Mullford & Racine 1029.*

15. CTENOPTERIS XANTHOTRICHIA (Klotzsch) Copeland, comb. nov.

Polypodium xanthotrichium KLOTZSCH, *Linnaea* 20 (1847) 376.*Polypodium ellipticosorum* FÉE, *Genera* (1850-'52) 239.

"Frondibus caespitosis, linearibus, pinnatifidis, flexilibus, pendulis, longis, versus apicem brevi-, versus basin longe attenuatis, sparsim longe pilosis; pinnis horizontalibus, elongatis, obtusis, inferioribus remotis, subtus pilis brevibus, stellatis, sulfureis dense pubescentibus, multisoris; soris laete-fuscis, elongatis, dein confluentibus; stipite brevi, filiformi rhachique rufescenti-piloso."

"Frondes 9-12 poll. longae, 6-12 lin. latae. Laciniae 3-6 lin. longae, 1½ lin. latae, Stipes filiformis, 3-6 lin. longus."

"In Columbia ad Meridam, Moritz n. 250? Guiana angl. Rich, Schomburgk n. 1172."

"A Polypodio cultrato Willd. differt: laciniis angustioribus, subtus sulfureo-pubescentibus, soris elongatis, dein confluentibus."—Kl., l.c.

16. CTENOPTERIS RHIZOPHORÆ Copeland, sp. nov.

Plate 7.

C. rhizomate erecto, breve, paleis 1.5 mm longis lanceolatis integris onusto; lamina sessile, 15 cm longa, 15-20 mm lata, utrinque valde attenuata, acuminata, usque ad apicem ipsum subpinnata, pinnis infimis aliformibus secus rhachin dilatatis, pinnis medialibus 2 mm latis, obtusis, integris, glabris, decurrentibus vix confluentibus, subcoriaceis, venis simplicibus; soris medialibus, impressis, usque ad 7-paribus; sporangiis nudis.

COLOMBIA, in mangrove swamp along Rio Dagua, alt. 0 to 5 m.

The acuminate apex pinnatifid to the tip is a conspicuous feature.

17. CTENOPTERIS CILIARIS (Fée) Copeland, comb. nov.

Polypodium ciliare FÉE, *Crypt. Vasc. Bras. I* (1869) 94, Plate 27, fig. 2.

"Frondibus oblongis, mollibus, pinnatifidis, villosis, stipitibus brevissimis; segmentis ovato-oblongis, obtusissimis, integerrimis, sursum gibbosis; pilis longis utrinque obsitis; sporotheciis sparsis, in qualibet lacinia 3-4, crassis, saepe apicularibus, rufis; sporangiis parvulis, pilis longissimis, rigidis, oculo nudo perfacile perspicuis; annulo 10-12 articulado, sporis subtrigonis."

"Habitat in Brasilia fluminensis (Glaziou, no. 961)."

"Filix parva, mollis, ad arbores suspensa."

"(Longueur: 7-9 centim. sur 7-9 millim. de largeur.)"

Looks like *Polypodium elasticum* Bory; short-stipitate; distinguished by numerous stiff hairs on the sporangia.

Polypodium ovaescens FÉE, *Crypt. Vasc. Bras I* (1869) 94, Plate 27, fig. 3.

"Frondibus pinnatis, linearibus, substipitatis, pilos longissimos flexibiles ferentibus; rachi flexuoso, tenuissimo atro; frondulis ovalibus obtusissimis,

sessilibus; sporotheciis apicularibus 2-3, rufis; sporangiis rotundis; annulo 10 articulato, pilis nigris, longissimis onusto; sporis ovalibus."

"Habitat in Brasilia fluminensi (Glazieu, no. 1722)."

"Filix parva, mollis, ad arbores suspensa."

"Longueur: 7-9 centim. sur 7-9 millim. de largeur."

Distinguished from *Polypodium ciliare* by pinnate, instead of pinnatifid fronds. Figure shows globose spores.

Fée, Crypt. Vasc. Bras. II 59, suggests reduction to *Polypodium ciliare*; [so reduced by C. Chr., Index]—but not to any form of *Polypodium cultratum* Willd. He also lists as distinct *Polypodium semioduatum* Hooker.

18. CTENOPTERIS ELASTICA (Bory) Copeland, comb. nov.

Polypodium elasticum BORY: WILLDENOW, Sp. Pl. V (1810) 183, non Rich. (1792) nomen.

Polypodium cultratum BORY: WILLDENOW, Sp. Pl. (1810) 187.

Polypodium leveilleanum DESVAUX, Prod. (1827) 232.

Polypodium flexile FÉE, 6 Mém. (1853) 9, Plate 2, fig. 3.

"P. frondibus linearibus pinnatifidis substipitatis pilosis, laciniis ovato-oblongis obtusissimis integerrimis, basi superiore gibbis, soris solitariis, W."

"*Polypodium elasticum*, Bory de St. Vincent."

"Elastischer Engelsüss. W."

"Habitat in montibus altis insulae Borboniae, arboribus parasiticum (v. s.)."

"Frondes tri-quadrillicares angustae diaphane elasticae pinnatifidae, laciniis ovato-oblongis inaequilateris basi superiore gibbis integerrimis obtusissimis, pilis longis sparsis utrinque obsitis. Videtur frons pinnata, sed basi evidenter pinnatifida laciniis minoribus. Sori solitarii in qualibet lacinia plerumque unicus rarius duo. Stipes brevissimus fuscus. W."—Willd., l. c.

I have seen no specimen from the Mascarene Region, though various writers have reduced *Polypodium elasticum* to *Polypodium cultratum*, I would hesitate to follow their example except for the statement of Christensen, Fl. Madagascar (1932) 154, "The variety from the Mascarene Region differs from the West Indies type chiefly by its very short rhizome and by the very short stipe." Since short rhizomes and stipes characterize what I regard as typical *Polypodium cultratum*, it seems altogether probable that they are one species. If this be so, the prior and valid specific name is *elastica*.

The type locality of *Polypodium cultratum* is Jamaica, where it must be very common. Over 30 collections are in hand. As they are remarkably uniform, I abstain from listing them.

Rhizome small, ascending, so densely beset with densely hirsute stipe-bases and roots that paleæ cannot usually be detected; if visible they may be 1 mm long, ciliate with ferruginous setæ 0.2 mm long. Stipes 5 to 15 mm long, slender, hirsute throughout but most densely so at base. Lamina 15 to 25 (rarely 30) cm long, one-tenth as wide, attenuate to both ends most conspicuously so downward. Rachis slender, black hirsute; pinnæ 3 to 5 mm wide, separated by a narrower space, rounded at apex, broadest at base, there partly adnate on the acroscopic side, short-decurrent, hairy, the marginal hairs partly longer and partly in clusters of two or three. Texture thin-herbaceous, costæ black, veins simple, short. Sori terminal on veins, in-framedial on lamina, commonly about 5 in a row; sporangia bearing one or more whitish hairs one to three times as long as the diameter of the sporangium.

Specimens from Cuba and Haiti match perfectly those from Jamaica.

From Mexico, *Münch 119*, *Purpus 1129*, *Matuda S 229* are typical. *Hinton 14280* is very long,—up to 45 cm,—and slender. *Matuda 2912* is large,—up to 60 cm long and 4.5 cm wide, with crowded pinnæ, and the lamina is less hairy and the sporangia more so than typical. It is from the same locality as *Matuda S 229* and distinct in appearance; perhaps specifically different.

The 11 specimens from Guatemala average larger than typical, but are reasonably uniform and fairly represent the species.

The material from Costa Rica, 8 collections, 6 of them from one locality,—is less uniform and less representative. The pinnæ are more crowded. The stipes are longer and less crowded, the paleæ accordingly more evident. Marginal hairs are less conspicuous, sometimes almost wanting, and solitary. Likewise, the setulæ on the sporangia are few on most collections, and short. No Costa Rican specimen is exactly *Ctenopteris elastica*, as represented in Jamaica; neither is it exactly any one species. In the confused genetic aggregate, *Ctenopteris elastica* seems to be a prominent component.

The single Panama specimen, *Pittier 5629*, is another variant, typical as to the ciliate margins, but with slender stipes 4 cm long.

From Venezuela, we have few and various specimens. *Sternermark 61694*, from the sources of the river Manantiales, alt. 2,350 m, and Roraima Expedition (British Guiana) 124, are

remarkably long-attenuate downward; they may represent a distinct species. *Fendler 10, Tate 463, 501* suggest *Ctenopteris reclinata*. *Steiermark 59588* is fairly typical *Ctenopteris elastica*.

Colombia specimens are nearly typical; *Moritz 250, Henri-Stanislav 1687, Killip & Garcia 33888*.

The only Peruvian specimen, *Bues A 47*, is variant toward *Ctenopteris reclinata*.

Ctenopteris elastica is here construed broadly. Future collections are likely to show that two or more additional species should be segregated.

GROUP OF CTENOPTERIS PENDULA

Key to the species

Fronds narrowly lanceolate or linear.

Pinnæ serrate-lobed 2. *C. melanotricha*

Pinnæ crenate or crenate-lobed.

Sori terminal on veins 3. *C. Hombersleyi*

Sori basal on veins 15. *C. Schwackei*

Pinnæ crenulate.

Sori deeply impressed 4. *C. depressa*

Sori superficial *C. patentissima*

Pinnæ entire.

Sori impressed.

Base truncate 11. *C. epiphytica*

Base moderately attenuate 1. *C. pendula*

Base long-attenuate 13. *C. simacensis*

Sori superficial.

Rootlike rhizomes present.

Stipe 2 cm long 5. *C. anfractuosa*

Stipe 5 cm long 8. *C. ecuadorensis*

Without rootlike rhizomes.

Paleæ suppressed 6. *C. Alfarii*

Paleæ evident.

Segments somewhat remote..... 7. *C. flexuosa*

Segments obtuse.

Segments approximate.

Fronds stipitate.

Stipe long-setose.

Lamina glabrous 9. *C. Phlegmaria*

Lamina pilose 10. *C. delicatula*

Stipe glabrescent 11. *C. epiphytica*

Fronds sessile or nearly so.

Sori plural.

Lime dots present	12. <i>C. cretata</i>
Lime dots wanting	14. <i>C. gradata</i>
Sorus one to each pinna	23. <i>C. antioqiana</i>
Segments acute	16. <i>C. Randallii</i>

Fronds broadly lanceolate.

Fronds evidently stalked.

Sori supramedial.

Rachis glabrous 17. *C. kaietura*

Rachis pubescent 18. *C. tenuicula*

Sori medial 19. *C. isidrensia*

Fronds sessile or nearly so.

Sori supramedial 20. *C. brevistipes*

Sori medial or inframedial.

Sori superficial *P. Eggersii*

Sori slightly impressed.

Fronds acute 21. *C. Jenmani*

Fronds caudate 22. *C. obovata*

1. CTENOPTERIS PENDULA (Swartz) J. Smith.

Ctenopteris pendula (Swartz) J. SMITH, Hist. Fil. (1875) 185.

Polypodium pendulum SWARTZ, Prod. (1788) 131; Syn. Fil. (1806) 33.

"*P. pendulum*, frondibus pinnatifidis, laciniis oblongis obtusis, fronde laxa sessili. Flor. Ind. occ. p. 1637."

"Schkuhr. Cr. Gew. t. 10."

"Jamaica."—Swartz, Synopsis.

Rhizome (caudex) short, erect, paleæ blackish-gray, ciliate by prolongation of anticlinal walls, surfaces naked; stipes congested, short (1 cm or less), winged upward and sometimes to the base; lamina up to 35 cm long and linear, usually shorter (15 cm) and linear-lanceolate, attenuate to both ends, rachis black, glabrescent; segments more or less remote above the decurrent-dilated confluent bases, 2.5 to 3 mm wide, obtuse or subacute, glabrous; sori small, medial or inframedial, impressed, terminal on inconspicuous veins, commonly 4 to 7 in a row; sporangia bearing several short setulæ which are evidently caducous because not evident on many specimens.

JAMAICA; *Maxon* 2795, Vinegar Hill, alt. 1,200 m, annotated as very rare, and with a letter from Lindman, "No. 2795 is a true *Polypodium pendulum* Sw.; conforms with the specimens in Hb. Swartz." Another excellent specimen is *Hart* 256; others from Jamaica are *Sherring* s. n., *Harris* 7371, *Hatch* 26, *Maxon* 2795, 9597, 10202, *Maxon & Killip* 993a. Also, Guadeloupe, *Duss* 4083, *Stehlé* 1205, 1418.

Hooker, Sp. Fil. IV 195, cites this species from British Guiana, Venezuela, Brazil and Peru; but our specimens from these sources, received as *Polypodium pendulum*, are all misnamed.

2. CTENOPTERIS MELANOTRICHA (Baker) Copeland, comb. nov.

Polypodium melanotrichum BAKER, Trans. Linn. Soc. II 2 (1887) 292.

"Eupolypodium: caudice erecto paleis subulatis crispatis vestito, stipite brevissimo gracillimo, frondibus oblongo-lanceolatis parvis flaccidis membranaceis glabris bipinnatifidis pinnis lanceolatis adnatis profunde pectinato-pinnatifidis inferioribus sensim minoribus, segmentis deltoideis acutis, venis brevibus simplicibus erecto-patentibus, soris globosis superficialibus costularibus ad apicem venarum impositis."

"Stipes and rhachis black, threadlike, glabrous. Lamina 3-4 in. long, an inch broad at the middle. Central pinnæ half an inch long, $\frac{1}{8}$ in. broad, with 6-8 pairs of deltoid segments with a single sorus in the center of each."

"Allied to the Brazilian *Polypodium achilliaefolium* Kaulf., but quite different in texture, in the shape of the segments, and by its very short simple veins."

Roraima. Expedition of 1884, No. 125: The only collection. Isotype in U. S. Nat. Herb.

3. CTENOPTERIS HOMBERSLEYI (Maxon) Copeland, comb. nov.

Polypodium Hombersleyi MAXON, Amer. Fern Jour. 20 (1930) 1.

"Eupolypodium. Plants epiphytic, small, very delicate, solitary. Rhizome suberect, 2.5 mm. long, about 1.5 mm. thick, densely paleaceous...; scales . . . acutish, 0.8-1.1 mm. long, 0.2-0.3 mm. broad, thin but firm, light brown, strongly reticulate, sparsely long-ciliate.... Fronds several . . . , subpendent, cespitose, 4-6 cm. long; stipes capillary, dark brown, very short (2-5 mm.), distantly grayish-pubescent, the hairs mostly geminate from an enlarged base; blades lance-linear, 8-11 mm. broad near middle, attenuate toward apex (extreme tip obtuse), abruptly reduced at base, obliquely pinnatisect throughout, the rachis . . . capillary, atropurpureous, minutely geminate-pubescent beneath; segments about 20 pairs, alternate, the larger . . . ones obliquely oblong, half their width apart, semiadnate and slightly decurrent, mostly rounded-obtuse at apex, 2-2.5 mm. broad, obliquely crenate-lobate nearly half way to the costa, the lobes subequal, 2 or 3 on either side . . . ; costae delicate, flexuous, immersed . . . ; veins oblique, simple, solitary at base of lobes, terminating in large round hydathodes . . . ; sori relatively large, 3-5 per segment, borne near the costa, terminal, slightly impressed; sporangia glabrous . . . ;

TRINIDAD, alt. 660 m, *Hombersley* 331.

Related to *Polypodium Randallii* Maxon, of Jamaica, which has reduced lower segments and is glabrous. Both are related to *Polypodium Alfarii*.

Collected again by Hombersley in the same place (No. 331a).

Ctenopteris Hombersleyi is distinguished from *Ctenopteris Alfarii* by evident ciliate paleæ, absence of dense hairs at base of stipe, and by comparatively symmetrical, oblong, crenate-lobate segments.

4. *Ctenopteris depressa* (C. Chr.) Copeland, comb. nov.*Polypodium degressum* C. CHR., Index (1905).*Polypodium immersum* FÉE, Crypt. Vasc. Bras. 1 (1869) 88, Plate 27, fig. 1, non Vahl.

"Frondibus linearibus, mollibus, sessilibus, pinnatifidis, abrupte terminatis; segmentis inaequalibus, remotiusculis, oblongis, obtusis, leviter crenatis, basi decurrentibus, horizontalibus, rimosis, sporotheciis profunde immersis, 4-6, in qualibet lacinia, is senectute confluentibus; sporangiis parvulis, glabris, sporis subtrigonis."

"Habitat in Brazilia fluminensi (Glaziou, no. 1721)."

"Filix elongata, flexuosa; ad arbores suspensa; surculo parvulo."

"(Longueur variable, 12-20 centim. sur 6-8 millim. de largeur.)"—Fée, l. c.

The plate shows the sporangium without setæ, the pedicel of one row of cells; it does not clearly show the veins. Paleæ tufted, 2 mm long, narrowly lanceolate, entire. Stipe undulate-winged down to the rhizome. Sori medial, terminal on the simple veins. The impressed sori are the most characteristic feature of the species.

Specimens: BRAZIL: Sao Paulo, Alto de Serra, alt. 800 to 900 m; L. B. Smith 1956, Ule 267, Brade 8397; STA. CATHARINA, Schmalz 203.

Both *Ctenopteris depressa* and *Ctenopteris subinaequalis* were distributed as Rosenstock, Fil. Austrobras. No. 288.

5. *Ctenopteris anfratuosa* (Kunze) Copeland, comb. nov.*Polypodium anfractuosum* KUNZE apud KLOTZSCH, Linnaea 20 (1847) 375.*Polypodium monticola* KLOTZSCH, Linnaea 20 (1847) 377.*Polypodium saxicolum* BAKER, Jour. Bot. 15 (1877) 264, non Sw.*Polypodium induens* MAXON, Bull. Torrey Bot. Club 32 (1905) 75.

"Frondibus caespitosis, linearibus, profunde-sinuato-pinnatifidis, utrinque attenuatis, membranaceis, rigidis; laciniis alternis, brevibus, ovatis, obtusis, patentissimis, glabris, subinde obtuse-triangularibus, distantibus, mono-tetrasporis; soris mediocribus laete-fuscis, pilis sparsis, rufescentibus interspersis, deinde confluentibus; rhachi stipiteque piloso-hispida, fusconigrescente."

"Lamina frondis 2-4 poll. longa, 3-5 lin. lata, Laciniae 2-2½ lin. longae, ½-2 lin. latae. Stipes filiformis, ½ pollicem longus."

"Merida Columbiae. Moritz n. 330?"—Kunze, l. c.

"The U. S. Nat. Herbarium contains two sheets of Moritz 330. One of these, Herb. No. 1431396, received from the British Museum, looks like a mixture, of which the plant on the left may be accepted as typical. Its segments are about $3 \times 1\frac{1}{2}$ mm. with glabrous surface. The frond on the right has segments about 3×3 mm. broadly rounded, with hairs in

the sori. I suppose that Kunze had the same mixture, and that his dimensions, "2-2½ lin. longae, ½-2 lin. latae," are an attempt to include both; and that the improbability of a species so diverse finds expression in his question mark,—“Moritz n. 330?”

The other sheet, No. 867053, was received from Rosenstock. It looks to the unaided eye like the plant accepted as typical on the British Museum sheet, but bears atropurpureous setæ on the nether surface, suggesting *Ctenopteris pilosissima*.

The most remarkable characteristic of *Ctenopteris anfractuosa* is the wirelike rhizome, apparently noticed only by Sodiro, Crypt. Vasc. Quit. (1893) 314,—“rhizomate filiformi, late repente, remote prolifero.” This is really conspicuous on a minority of specimens, but can be detected on the majority which have not lost it completely in collection and preparation.

Specimens received or already determined as *Ctenopteris anfractuosa* are: MT. RORAIMA, Tate 504, Steyermark 58710, 58731; COLOMBIA, Lehmann 3010, 7365, Henri-Stanislas 1683; ECUADOR, Penland & Summers 207, Steyermark 53612; PERU, Cook & Gilbert 1168, Bues 1945.

Specimens received or determined as *Polypodium induens*: JAMAICA, Hart s. n., Sherring s. n., E. G. Britton s. n., Maxon 1022, 1024, 1324, 1332, 2770, Maxon & Killip 711, 1077 a; HISPANIOLA, v. Tuerckheim 3221, Fuertes 1940 b, Ekman 5316, H6893, 7373, H. 13585, Picanda 1006, Holdridge 1366, Curtis 5; CUBA, Acuña 9977; GUADELOUPE, Stehlé 1468. GUATEMALA, Johnson 533 Steyermark 30020. HONDURAS, Yuncher, et al. 6197, Merrill, et al. 15678 bis, Williams & Molina 10387, 11142, 12790, 13688 bis; COSTA RICA, Tonduz 12197, Pittier 2000, Standley 38367, 35403, 38566, 38667, 38749, Standley & Torres 47752, Standley & Valerio 44598, 48052, 50466, Skutch 3229, Torres 66, Lankester 902, Maxon 278, Maxon & Harvey 8232, 8434, 8448, 8487; PANAMA, Maxon 5291, 5486, 5714, Woodson, et al. 829, Cornman 1042, 1326, Seibert 196, Killip 5194.

It may be observed that, as I have found the specimens identified, *Polypodium induens* seems to range from Panama North, *Polypodium anfractuosum* from Colombia East and South, I cannot distinguish them. Baker identified an Ecuador specimen for Sodiro as his *Polypodium saxicolum*. A Bolivian specimen, 1. Mille, was named *Polypodium saxicolum* by reference to Sodiro.

Polypodium monticola Kl. was reduced to *Polypodium anfractuosum* by Hieronymus, Hedwigia 48 (1909) 377, on the evidence of authentic specimens of both in his hands together

6. CTENOPTERIS ALFARII (Donnell-Smith) Copeland, comb. nov.

Polypodium Alfarii DONNELL-SMITH, Bot. Gaz. 33 (1902) 262; MAXON, Proc. Biol. Soc. Wash. 46 (1933) 106; CHRIST, Bull. Bois. II 5 (1905) 4.

Polypodium oligosorum MORITZ, Bot. Zeit. 12 (1854) 855, *nomen nudum*; METTENIUS *apud* KUHN, Linnaea 36 (1869) 132, *non* Klotzsch (1847).

"Eupolypodium.—Frons parva pendula glabra pinnata linearis deorsum paulatim attenuata, pinnis utrinque 15–35 adnatis contiguis triangularibus vel e basi triangulari-linearibus integris margine superiore ad basin dilatato angulo recto patentibus, inferiore decurrentibus, venis simplicibus paucis brevissimis in pinnarum dimidia parte exteriori nullis, soris 1–6 costae approximatis."

"Stipites fasciculati filiformes arcuati castanei inferne pilis patentibus vestiti 1½–2½ cm longi. Frons membranacea 10–20 cm longa 1.5–4 cm lata, rhachi ebenea. Pinnae distinctae alternae medio 2–3 mm latae, inferiores laxiores, infimae ad alas cuneatas reductae, costa ebenea infra apicem evanescente, vena basali superiore ceteris longiore obsolete sorifera, soris majusculis rotundis, extimis ad costam subimpositis, paraphysibus nullis..."

"In truncos arborum, Sierra Alta de Navarro, Prov. Cartago... alt. 2000 m, Mai. 1901, Anastacio Alfaro, n. 8063 Pl. Guat. & c., qu. ed. Donn. Sm."—Donn.—Smith, l. c.

"In general appearance *P. Alfarii* somewhat suggests *P. phlegmaria*.... It differs widely from that... especially in its complete lack of rhizome scales, its delicately membranaceous leaf tissue and long-setose sporangia, and its far from glabrous condition."—Maxon, l. c.

As to the paleæ: The stipes of well developed plants are densely fascicled, and at the very bottom, perhaps for two millimeters, are densely pilose. These conditions dwarf paleæ and in various species of *Grammitis* and *Ctenopteris* inhibit their formation. As Mettenius ascribed "paleis minutissimis" to his *Polypodium oligosorum*, I have examined every available individual, but could not positively detect any paleæ, even on young and lax specimens.

As to the shape of the pinnæ, they vary remarkably, as noted in Donnell-Smith's description and by Christ.

Specimens: COSTA RICA, *Alfaro* 73 (No. 8063 of Donnell-Smith; 8 packets in U. S. Nat. Herb.), *Brade* 83, *Werkle* 569, *Maxon* 394, 429, *Standley* 38166, *Standley & Valerio* 49843, 51558, 52119, 52203, 52233, 52287, 52289, *Valerio* A 12, 141, 2351, *Skutch* 2815; PANAMA, *Killip* 5315, 5356, *Cornman* 1297; VENEZUELA, *Moritz* 460 (isotypes of *Polypodium oligosorum*), *Pittier* 10071a.

7. CTENOPTERIS FLEXUOSA (Maxon) Copeland, comb. nov.

Polypodium flexuosum MAXON, Cont. U. S. Nat. Herb. 17 (1916)
597, Plate 42.

"Plants epiphytic, the several fronds pendent, fasciculate, 10 to 15 cm. long. Rhizome decumbent, less than 1 cm. long, 2 to 3 mm. in diameter, densely paleaceous, the scales brownish castaneous in mass, 1 to 1.7 mm. long, linear-deltoid or nearly linear from a rounded base, about 0.3 mm. broad, semitranslucent (the partition cell walls darker visually than the yellowish or yellowish-brown outer walls), long-ciliate throughout, the cilia divergent, nearly straight, acicular, unicellular, yellow, 0.2 to 0.4 mm. long; stipe slender, 1 to 2 cm. long, 0.3 to 0.5 mm. in diameter, light brown dull, scantily long-pilose; lamina 9 to 14 cm. long, 1 to 1.7 cm. broad, linear, arcuate, attenuate in both directions, alternate pinnatifid nearly to the slender blackish flexuose elevated rachis, the sinuses very wide, rounded; segments 15 to 25 on each side, exactly alternate, slightly oblique, 5 to 9 mm. long, 2.5 to 3 (3.5) mm. broad at the middle, . . . obtuse, both leaf surfaces bearing short multicellular simple or branched hairs, the upper surface hirsute also with long, stiff, unicellular hairs, . . . ciliate; . . . veins 3 or 4 pairs, simple; . . . sori 2 to 4 pairs, small, distant, superficial, supramedial or subterminal; . . . sporangia rigidly long-setose, the setae yellowish brown . . . annuuls 14 or 15-celled . . ."—Maxon, l. c.

Type: *Shafer 8037*: Cuba, Camp la Gloria, s. of Sierra Moa, Oriente.

Resembles *Polypodium pendulum*, which has much larger, distinctly clathrate, shorter-ciliate rhizome scales, is neither hirsute nor ciliate, and has somewhat impressed medial sori.

8. CTENOPTERIS ECUADORENSIS (C. Chr.) Copeland, comb. nov.

Polypodium ecuadorensis C. CHR., Index (1906) 524.

Polypodium subscabrum HOOKER, Sp. Fil. IV (1862) 183, Plate 274A,
non Kl.

"Eupolypodium; fronds 3-6 inches long pinnatifid broadlinear membranaceous stipitate adpressedly scabrous viscidulous, segments 3-5 lines long lanceolate-linear subobtuse horizontal alternate distant multisorous, veins pinnately branched branches short soriferous, sori small dirty-brown uniserial opposite, stipes and rachis filiform brown at length glabrous."—Kl. in Linnaea, XX. p. 377. Metten. p. 43.

"Hab. Colombia, Merida, Moritz, n. 332. Ecuador, on trees, Valley of Lloa, Jameson. New Granada, Sierra Nevada, alt. 10,000 feet, Schlim n. 843.—Among other difficulties attending the study of the Ferns, is that arising from not finding the descriptions of authors tally with their own specimens. In the present case of the plant which is authority for the species, I possess an original from Klotzsch as 332 of Moritz, and the same is quoted by Mettenius; but my specimens are not scabrous, nor have they linear (Metten.) or linear-lanceolate (Kl.) segments, but rather oval-oblong; and certainly none of my specimens approaches 1-1½ foot in length, with segments 1½ inch long, according to Mettenius, as may be

seen by our figure. The species is remarkable for the long purplish hairs on the stipes, and still longer on the margins of the segments."—Hooker *Rimbach, Ros. Fil. ecuad.* 37.

9. *CTENOPTERIS PHLEGMARIA* (J. Smith) Copeland, *comb. nov.*

Polypodium Phlegmaria J. SMITH, London Jour. Bot. 1 (1842) 194;

MAXON, Proc. Biol. Soc. Wash. 46 (1933) 106.

Polypodium towarensense KLOTZSCH, Linnaea 20 (1847) 375.

Polypodium subdimidiatum BAKER, Syn. Fil. (1867) 324.

"Fronibus linearibus pinnatis glabris, pinnis ovato-oblongis oblique undulatis subdimidiatis sessilibus, basi superne truncatis gibbosis, inferne decurrentibus, rachi alata, soris 3-4 venulis terminalibus discretis. Near Roraima, British Guiana, Schomburgk."—J. Smith, l. c.

Paleæ 2 mm long, lanceolate, fuscous, entire; stipes congested, winged nearly or quite to the base; lamina 10 to 39 cm long, 1 cm broad, pendent, glabrous, rachis filiform, black, winged, segments commonly 4 mm long, 3 mm wide, rounded, firm herbaceous veins few, simple; sori inframedial, superficial or slightly impressed, sporangia naked.

Specimens: Photograph of type, *Schomburgh* 161. BRITISH GUIANA, *Roraima Exped.* 179; VENEZUELA, *Steyermark* 58972; COLOMBIA, *Cuatrecasas, et al.* 12438a, *Lehmann* 7589; PERU, *Bues* 825. The Peruvian specimen has the segments more than typically elongate.

10. *CTENOPTERIS DELICATULA* (Martens & Galeotti) J. Smith.

Ctenopteris delicatula (Martens & Galeotti) J. SMITH, Bot. Voy. Herald (1854) 227.

Polypodium delicatulum MARTENS & GALEOTTI, Mém. Acad. Brux. 15 (1842) 35, *Plate* 7, *fig.* 1; MAXON, Proc. Biol. Soc. Wash. 52 (1939) 117.

Polypodium heterotrichum BAKER *apud* JENMAN, Jour. Bot. 17 (1879) 262.

"Fronde tenella, pilosa, brevi-stipitata, pinnata, lineari-lanceolata; pin-nulis lineari-oblongis, obtusis, integerrimis, imatis; soris biserialibus, sub-confluentibus, pilosos."

"Frons 2-4-pollicaris, pinnae 3 lineas longae."

"Obs. Species affinis *P. trichomanoidei* Sw.; at differt fronde pinnata, non pinnatifida; pinnis sublinearibus, non coadunatis; soris pluribus biserialibus."

"Collect. H. Galeotii, no. 6378. Novembre."—Mart. et Gal., l. c.

Mexico: Oaxaca, alt. 7,000 to 8,000 ft.

Maxon has described the paleæ in great detail,—more than I have been able to verify. "The slender blackish rachis together

with both surfaces of the blade reddish-pilose like the stipe, also densely but minutely glandulose-pubescent. "sporangia glabrous; the annulus 12-celled.

Specimens: MEXICO, Type fragment in U. S. Nat. Herb., *Pringle 13494*; GUATEMALA, *Skutch 96 b, 213*; JAMAICA, *Hart 242, Bot, Dept. Jamaica 191. Maxon 9870, 9951, 9964, Orcutt 5315, 5318, Hatch 28, Hitchcock 9372.*

11. CTENOPTERIS EPIPHYTICA Copeland, sp. nov.

Plate 8.

C. minima, rhizomate erecto paleis minutis brunneis integris vestito; stipitibus fasciculatis, 2-3 cm longis, glabrescentibus; lamina ca. 4 cm longa, 1 cm lata, subacuta, pinnata, herbacea, glabra, basi truncato, rhachi minutissime fibrillosa; pinnis obtusis; adnatis, integris, venis simplicibus; soris medialibus, leviter impressis, sporangiis nudis, sporis triletis.

COLOMBIA, Dept. del Valle, Rio Calima, alt. 5 to 50 m; *L. Cuatrecasas 16723.*

12. CTENOPTERIS CRETATA (Maxon) Copeland, comb. nov.

Polypodium cretatum MAXON, Amer. Fern Jour. 5 (1915) 51.

Polypodium albopunctatum BAKER apud JENMAN, Jour. Bot. 15 (1877) 265, non Raddi.

"*Eupolypodium*... Stipes thickly tufted, from a slender, very shortly elongating, rhizome, with black scales, 0-1½ inches long, slender, thinly hairy; fronds flaccid, 3-5 inches long, 2-6 lines wide, pinnatifid; rachis black, filiform, little flexuose; segments alternate, close, sometimes imbricating, numerous, spreading horizontally, bluntly and shortly oblong, adnate at the base, not dilated above, shortly decurrent on the inferior side, 1½-3 lines long, 1-1½ lines wide; margin entire or crenulate-repand; lower pinnæ reduced and more distant, all ultimately deciduous, the hairlike rachises only remaining mixed with the existing fronds; texture very thin; surfaces, with rachis, thinly clothed with soft hairs; veins shortly, simply branched; sori dark brown, 2-6, at the ends of the vein branches, nearer the midrib than margin; upper surface conspicuously sprinkled with white crustaceous dots, corresponding to the sori beneath. No. 34, Herb. Kew, 1877."—Baker, l. c.

Common at major altitudes in Jamaica, Cuba, prov. Oriente, *Ekman 7168, Morton & Acuña 4508*; HAITI, *Ekman H7506.*

13. CTENOPTERIS SIMACENSIS (Rosenstock) Copeland, comb. nov.

Polypodium simacense ROSENSTOCK, Fedde's Repert. 25 (1928) 60.

"*Eupolypodium*, Rhizoma breviter repens, adscendens, paleis brevibus deltoideis, obtusis, atrobunneis, longe albidofimbriatis apice ornatum; stipites filiformes, flexuosi, atterime, sparse pilosuli. ad 3 cm longi; laminæ alongato-oblongae, obtusae, utro versus, deorsum longius, angustatae, olivaceae, herbaceo-chartaceae, glabrae, ad 10 cm longae, 12 mm latae,

profunde pinnato-partitae; segmenta ad 20 utrinque, medialis maxima ad 6 mm longa, 2½ mm supra basin lata, e basi inaequali, postica paulo latiore, lineari-oblonga, obtusa, subintegra vel undulato-crenulata, inferiora sensim decrescentia, demum dilatato-auriculiformia; rhachis supra immersa, subtus elevata, aterrima, pilis paucis brevibus adspersa; nervi ad 6-8 utrinque, manifesti, breves, simplices vel apice spurie furcati; sori profunde impressi, terminales vel ramo antico valde abbreviato impositi, medii inter costam et marginem."

"Bolivia: Hacienda Simaco supra viam ad Tipuani, 1400 m alt., 1, 1920, leg. Dr. O. Buchtien, no. 5259."

Distinguished from *Polypodium tenuiculum* Fée by being smaller, with weaker axes, less delicate texture and long-hairy rachis. The paleæ of *Polypodium simacense* are very densely ciliate. *Polypodium ciliolēpis* C. Chr., also from the Bolivian Andes, is more coriaceous, pinnate toward the base, with nerves almost reaching the margin.

With two excellent isotype sheets, I find the veins strictly simple, the sori terminal on them, approximately medial between midrib and margin, and distinctly impressed.

14. **CTENOPTERIS GRADATA** (Baker) Copeland, comb. nov.

Polypodium gradatum BAKER, Flora Bras. I² (1870) 513.

Polypodium hirsutulum FÉE, Crypt. Vasc. Bras. I (1869) 87,

Plate 36, fig. 2, non Raddi.

"Frondibus fasciculatis breviter petiolatis pendulis ligulato-lanceolatis totis pinnatis subcoriaceis utrinque pilis brunneis sparse vestitis, pinnis contiguis lanceolato-ligulatis obtusis integerrimis, inferioribus sensim ad aurículas rotundatas reductis, venulis simplicibus 5-6-jugis; soris rotundatis costalibus, utrinque 4-6 pro pinna."

"Caudex erectus, brevis, paleis linearibus brunneis 1 lin. longis membranaceis sparse vestitus. Stipites 6-18 lin. longi, erecti, obscure brunnei, substricti, graciles dense breviter brunneo-pubescentes. Lamina utrinque primum laete-demum obscure viridis, pilis mollibus brevibus sparse vestita, ligulato-vel spathulato-lanceolata, 4-6 poll. longa, 8-12 lin. lata, tota paene vel perfecte ad costam pinnata; pinnis 15-20-jugis, subpatentibus, basi contiguis aegre dilatis, mediis 4-6 lin. longis, deorsum 2-3 lin. latis, inferioribus fere inde e medio frondis decrescentibus, infimis ad aurículas rotundatas reductis. Costa primaria immersa, paullulum brunneo-pubescent. Venae immersae sed conspicuae, erecto-patentes, simplices, pinnarum maximarum, 5-6-jugae, distincte intra marginem evanescentes. Sori ½ lin. lati, superficiales, paraphysibus copiosis intermixti."

"Habitat prope Rio de Janeiro. Glaziou 2460."—Baker, l. c.

SAN PAULO, *Leite 3571, Brade 5226*; ESPIRITU SANTO, *Mejia 4052*; S. CATHARINA, *Schmalz, Rosenstock 209*.

15. CTENOPTERIS SCHWACKEI (Christ) Copeland, comb. nov.

Polypodium Schwackei CHRIST, Pl. Nov. Min 2 (1900) 20, not seen, Bull. Boiss, II 2 (1902) 370.

"Très voisin de *P. moniliforme* Leg. dont il diffère par les frondes dont les segments n'atteignent pas le rachis mais laissent une aile assez laege; surtout la pointe de la fronde est seulement crènelès et allongé. Le tissue est herbacees, le rachis faible, non raide, vert foncé, non couleur d'èbène, les segments triangulaires obtuses, non arrondis, le stipe presque nul, les sores a 3 ou 4 par lobe et attetgnant sa pointe.

"Hab. Serra de Ouro Preto, 1. Schwacke, no. 9488."—Christ, 1902.

Rhizome erect, densely clothed with entire, lanceolate, brown paleæ 2 mm long. Stipe 1 cm long, clothed with fuscous hairs less than 1 mm long; lamina 10 cm long, 14 mm wide, base attenuate, pinnatifid to a wing 0.6 mm wide, rachis invisible, surfaces and margin sparsely setose, costæ and veins immersed, falling short of the margin; sori superficial, costal, commonly 4 pairs, each occupying a suppressed branch-vein, sporangia naked, spores globose.

In Herb. Univ. Calif. is a specimen from Est. Santa Catharina, 1. Schmalz 192.

16. CTENOPTERIS RANDALLI (Maxon) Copeland, comb. nov.

Polypodium Randalli MAXON, Amer. Fern Jour. 18 (1928) 46.

"Eupolypodium. Plants epiphytic, small, very delicate. Rhizome erect, 2-3 mm. high, about 1 mm. thick, densely paleaceous at apex; scales lance-ligulate, 0.7-1 mm. long, thin, yellowish-brown, reticulate, hair-pointed and sparsely long-ciliate (the hairs delicate, whitish laxly curved, 6-10 cells broad near base; cells subrectangular, with very large lumina, the partition walls thin but definitely sclerotic, the outer walls hyaline. Fronds 5-12, laxly ascending, cespitose, 2-5 cm. long, exstipitate; blades linear or narrowly oblanceolate, 5-8 mm. broad, acutish at apex, acute or subattenuate at base, obliquely pinnatisect throughout, the rachis blackish, filiform, flexuose, evident and minutely appressed-pubescent beneath, the hairs distant, short, whitish, geminate or subfasciculate from a branched glandular base; segments 8-16 pairs, alternate, narrowly triangular, acute or acutish, mostly 3-5 mm. long, 2-3 mm. broad at the fully adnate, oblique or subdecurrent base, the lowermost 2 or 3 pairs gradually much reduced, long-decurrent, finally evident as a flexuous greenish wing (1 mm. broad or less); segments subentire, or often subauriculate just beyond the distal base, or the largest ones with as many as 2 relatively large crenations on both distal and proximal margins; costa capillary, immersed, terminating far from the apex; vein branches few 1-4 in all), oblique, very short, terminating in conspicuous round hydathodes, the sori (1-4) also terminal, small; distant, borne near the costa, slightly impressed; sporangia glabrous . . . "—Maxon, l. c.

JAMAICA, West of Gossamer Peak, St. Thomas, alt. 800 to 900 m; *Maxon 9280*.

Ctenopteris Randallii differs from *Ctenopteris Alfarrii* in being much smaller, with less densely fascicled fronds practically sessile, without dense hairs at base, and accordingly with evident paleæ, the lower pinnæ decurrent and shading into wings. Known by the type collection only.

17. *CTENOPTERIS KAIETURA* (Jenman) Copeland, comb. nov.

Polypodium kaietorum JENMAN, Ferns . . . Brit. West Indies . . . (1908) 262.

"Stipites tufted, from a small short-creeping rootstock, $\frac{1}{2}$ -1 in. long black puberulous ciliate. Fronds fully pinnate, 3-5 in. l., $\frac{1}{2}$ - $\frac{3}{4}$ w. reduced at the base but not decurrent, the apex terminating in a caudate sinuate point, coriaceous, pellucid, brown-green slightly ciliate, mostly so on the margin or quite naked eventually. Lobes close or with a narrow space between them, round ended, broadly adnate at the base, 1 line wide, 3-4 lines long entire. Rachis filiform, flexuose black ciliate-puberulous. Veins pinnate, the branches simple and short of the margin; Sori sunk, separate, median or near the edge, terminal and occupying all the veinlets, glandulose but not papillose on the upper surface."

"Guiana; rare on trees in forest above the Kaieteur Fall. *Jenman*, n. 1423. Intermediate in general aspect between *P. jubiforme* and *P. puberulum*, and best marked by its relatively wide fronds; rather long caudate, terminal segment, (often however broken away) the stipites not winged by decurrent pinnae, and medial or intramarginal Sori.-Endemic."—*Jenman*, l. c.

Typical material collected in Trinidad by *Homersley 120* and *s. n.*; paleæ dark and narrow; sori slightly immersed; sporangia with annulus of 14 indurated cells; spores globose.

Probably identical with *Ctenopteris kaietura* are *Schultes 5636*, from Colombia, and *Shafer 4032*, from Oriente, Cuba, alt. 900 m.

18. *CTENOPTERIS TENUICULA* (Fée) Copeland, comb. nov.

Polypodium tenuiculum FÉE, *Genera* (1850-'52). 239.

Polypodium lasiolepis METTENIUS: KUHN, *Linn.* 36 (1869) 130.

"Frondibus pinnatifidis, ovato-elongatis; stipite brevi, tomentoso; rachi piloso, pilis rigidis, acutis; rhizomate repente, segmentis complanatis, membranaceis, tenuibus, obtusissimis, glabris, angulum 50° cum rachide metientibus; nervillis simplicibus, abbreviatis, apice globoso, turgido, fertili; mesoneuro flexuoso, nigrescente; sporotheciis remotis, distinctis, apicularibus; lamina in parte prolifera, leviter depressa; sporangiis parvulis, pedicello brevi; annulo 11 articulado; sporis parvulis, ovoideis, rotundis, nigrescentibus."

"Habitat in Guadelupa. (L'Herminier.)"

"Filix dendricola, tenuis, complanata; sporotheciis supra impressis."

"(Dimensions: longueur totae, 15-16 centim.; le stipe est à la fronde: 1 : ou à 6. Les plus grands segments atteignent 2 centim.; nous en comptons une vingtaine . . ."—Fée, l. c.

POLYPODIUM TENUICULUM Fée var. BRASILIENSE Rosenstock.

Polypodium tenuiculum FÉE var. *brasiliense* ROSENSTOCK, Hedw. 56 (1915) 370.

"Varietas textura subconriaceo-chartacea, venis inconspicuis, costa mediana nigra et glaberrima a typo diversa."

RIO DE JANEIRO, Serra de Itatiaya; *Tamandaré* & A. C. *Brade* 6465.

POLYPODIUM TENUICULUM var. ACROSORA Hieronymous.

Polypodium tenuiculum var. *acrosora* HIERONYMOUS, Bot. Jahr. 34 (1904) 510.

Paleæ up to 7 mm long and 1 mm wide, densely ciliate; sori confined to upper part of segments, 5 or less.

ECUADOR, alt. 2,500 to 2,900 m; *Lehmann* 5727.

The Herb. Univ. Calif. are: *Brade* 6465 (isotype of var. *brasiliense* Ros.), and *Luetzelburg* 6727, both from Rio. Veins simple.

POLYPODIUM FERRUGINEUM MARTENS ET GALEOTTI.

Polypodium ferrugineum MARTENS et GALEOTTI. Mém. Acad. Brux. 16 (1842) 36, Plate 7, fig. 2.

"Fronde parvula, brevi-stipitata, oblongo-lineari, acuminata, subglabra, pinnata; pinnis linearibus, adnatis, approximatis, parallelis, inferioribus sensim minoribus; soris biserialibus congestis, ferrugineis, rachi pubescente.

"Obs. Species affinis *P. incano* Swartz, a quo differt praecipue fronde non squamata, laciniis anguste linearibus."

"(Collect. H. Galeotti, no 6354.) Octobre."

Rare; alt. 3,000 to 4,500 ft; Oaxaca.

Martens & Galeotti's figure shows this to be a *Ctenopteris*, but not *C. jubæforme*. Christensen, Index, treats it as a variety of *Polypodium jubæforme*.

A minute fragment in U. S. Nat. Herb. shows bright rust-yellow sporangia.

The only recognized collection is the type; it is not mentioned by Conzatti.

19. CTENOPTERIS ISIDRENSIS Copeland, sp. nov.

Polypodium isidrense MAXON in herb.

C. rhizomate adscendente vel brevi-repente, parva, paleis parvis 1 mm longis late lanceolatis ciliatis sparso; stipitibus gracilibus, 1-3 cm longis, minute pubescentibus; laminis lanceolatis, 10-15 cm longis, 2 cm latis, utrinque attenuatis, vix ad rhachin nigram pinnatisectis; segmentis proximis, 2 mm latis, obtusis, glabris, firmis, integris vel undulatis, margine subdeflexis; venis inconspicuis, simplicibus; soris terminalibus, medialibus, conspicue impressis, utrinque latere costæ 5-7; sporangiis nudis, annulo 12-cellulare, sporis globoso-tetrahedralibus.

COSTA RICA, *Standley & Valerio 49881*, type, "On tree in wet forest, Yerba Buena, north-east of San Isidro, Provincia de Heredia, altitude about 2,000 meters." Other specimens, all from Costa Rica, *Standley & Valerio 48164, 48171, 49998, 50474, 51607, 51630*.

Most similar to *Ctenopteris tenuicula* (Fée), from which it is distinguished by smaller and sparser paleæ, narrower fronds, medial and conspicuously impressed sori.

20. CTENOPTERIS BREVISTIPES (Mettenius) Copeland, comb. nov.

Polypodium brevistipes METTENIUS *apud* KUHN, *Linnaea* 36 (1869) 131.

"Rhizoma repens, abbreviatum, paleis ferrugineo-fuscis, lanceolatis, acuminatis, glabris vestitum; folia chartacea, approximata, disticha, siccitate glabra; petiolus abbreviatus; lamina $3\frac{1}{2}$ '' longa, 9' '' lata, lanceolata, profunde pinnatipartita; laciniae contiguæ, oblique patentès, mediae 5'' longae, $1\frac{1}{2}$ ''' latae e basi latiore elongato-oblongae obtusissimae, integerrimae, utrinque decrescentes, inferiores triangulares ovatae, infimae longe decurrentes; nervi catadromi, obliqui, apice incrassato soriferi; sori rotundati, margini subapproximati; sporangia nuda: Paraphyses nullae."

"*Polypodium flabelliforme* Griseb. fl. Brit. Westind. p. 700 ex parte.—*Polyp. jubaeforme* Hook. Spec. Fil. IV, p. 186 ex parte."

"Brasilia, Rio Janeiro.—Trinidad.

"Habitu *P. lasiolepidis*, paleis rhizomatis integerrimis ab *P. lasiolepidis* et *P. pendula diversa*, priori sororum dispositione congruens, nervis ubique catadromis cum *P. flabelliforme* non comparandum."—Mett., l. c.

POLYPODIUM DULUM var. GARDNERIANUM Baker.

Polypodium dulum var. *gardnerianum* BAKER, Fl. Bras. I² (1870) 511.

"Lamina crassior, 4-12 poll, longa, 8-15 lin. lata, aegre ad costam pinnata, siccitate grisea, infra paullulum pruinato-furfuracea, pinnis contiguis erecto-patentibus, costis immersis, venulis immersis obscuris 8-9-jugis, soris utrinque secus costam 8-9-jugis, marginalibus."

"An species distincta? Ad *P. inaequali* accedens?."—BAKER, l. c.

RIO JANEIRO, *Brade* 9989, *Luekzelburg* 13110, 13888; SAN PAULO, *Brade* 5382; SANTA CATHARINA, *Schmalz* 112a; all in Herb. Univ. Calif.

21. *CTENOPTERIS JENMANI* (Underwood: Maxon) Copeland, comb. nov.

Polypodium Jenmani UNDERWOOD: MAXON, Cont. U. S. Nat. Herb. 16 (1912) 62.

Polypodium lasiolepis JENMAN, Bull. Dept. Bot. Jamaica 4 (1897) 118, non Mett.

"The Jamaica plant described by Jenman as "*Polypodium lasiolepis* Mett." is not very closely related to *P. lasiolepis* of the Lesser Antilles, which is itself (together with *P. granadense* Jenman) apparently a synonym of *P. tenuiculum* Fée. Jenman's description is very complete. He compares the species with *P. pendulum* Swartz, pointing out, in part, that it differs from that species in its stronger rhizome, close and more decurrently adnate ciliate segments, slightly hairy surface, terminal superficial sori, absence of glands, and different apex and base. He adds 'It is also erect in growth, and the veins and midrib of the pinnæ are not raised on the upper side.'"

Not very close to *Polypodium pendulum*.

Specimens: JAMAICA, *Maxon* 1535 (=Underwood 2606), and 961.

22. *CTENOPTERIS OBOVATA* Copeland, sp. nov.

Polypodium pendulum var. *boliviense* ROSENSTOCK, Fedde's Repert. 25 (1928) 60.

C. foliis brevioribus latioribusque (6–12 cm longis, 3–5 cm latis), stipite longiore tereto a C. pendula diversa, soris utroque latere costæ usque ad 11, medialibus, latere acroscopico venarum insertis.

BOLIVIA, Hacienda Simaco, alt. 1,400 m, *Buchtien* 5256, type; also, San Carlos, alt. 900 m, *Buchtien* 210; both collections in Herb. Univ. Calif.; No. 210 in U. S. Nat. Herb. also.

I find no setulæ on the sporangia, but do not trust this as a distinction from *Ctenopteris pendula*, because I cannot find them on all collection of *Ctenopteris pendula*.

I describe this as new, with a new name, instead of using Rosenstock varietal name, which would invite confusion with *Polypodium bolivianum* Ros.

Polypodium obovatum Mett. is a *Pyrrosia*.

23. *CTENOPTERIS ANTIOQUIANA* (Baker) Copeland, comb. nov.

Polypodium antioquianum BAKER, Jour. Bot. (1881) 205.

"Stipes very short, densely tufted; basal paleæ minute, subulate, Fronds linear, 1–3 in. long, ¼ in. broad, simply pinnate, moderately firm in

texture, with an elastic black thread-like rachis, both surfaces furnished with a few long hairs. Pinnæ 20-30-jugate, oblique-oblong, adnate to the rachis, about a line broad, the lower ones gradually dwarfed, each with a single medial vein, with a short fork at the base. Sori solitary on the pinnæ, placed at the end of the midrib near their tip, orbicular, superficial."

Collected by *Kalbreyer 1703* in Antioquia, New Grenada, alt. 1,500 m.

The U. S. Nat. Herb. contains a photograph and some mounted fragments of the type of *Polypodium antioquianum*. From these, I cannot be sure, but it seems probable that the paleæ are ciliate, and the sporangia naked.

Here probably belongs also, *Jameson 790*, *Polypodium oligosorum* Mett. non Kl., from Ecuador.

GROUP OF CTENOPTERIS SUSPENSÆ

(Base of lamina cuneate)

Key to the species

Some laminar hairs bearing long branches 10. *C. Stella*
Hairs all simple.

Segments acute.

Lime dots on upper surface 9. *C. semihirsuta*

Lime dots wanting.

Segments 3 mm wide above base 8. *C. Truncorum*

Segments broader.

Neither surface sparsely setose.

Frond over 60 cm long 5. *C. lehmanniana*

Fronds up to 50 cm long 6. *C. Chrysleri*

Neither surface freely setose.

Stipe elongate 7. *C. dolorensis*

Stipe very short *C. sericeo-lanata*

Segments obtuse.

Sporangia bearing single long setulæ.

Segments mostly in contact 3. *C. contacta*

Segments not mostly in contact 2. *C. exornans*

Sporangia bearing plural setulæ 1. *C. suspensa*

Sporangia naked or with mere fibers.

Herbaceous 4. *C. taxifolia*

Coriaceous 11. *C. vernicosa*

1. CTENOPTERIS SUSPENSÆ (Linnæus) Copeland.

Ctenopteris suspensa (Linnæus) COPELAND, *Genera* (1947) 219.

Polypodium suspensum LINNÆUS, *Sp. Pl.* (1753) 1084; Swartz, *Syn. Fil.* 32.

"*Polypodium frondibus pinnatifidis glabris lobis semiovatis acutis.*"

"*Polypodium pendulum glabrum.* Plum. *Fil.* 67. to 87."

"Polypodium asplenii folio brevi, pendulum, Pet. fl. 24. t. 1. f. 15."

"Habitat in America meridionali."—Linnaeus, l. c.

"Frondibus pinnatifidis laciniis semiovatis acutiusculis."—Linnaeus, l. c.

"Plum. Fil. t. 87."

"Jamaica."—Swartz, l. c.

POLYPODIUM ASPLENIFOLIUM Linnaeus.

Polypodium asplenifolium LINNÆUS, Sp. Pl. (1753) 1804; MAXON, Pterid. Porto Rico (1926) 410.

"Polypodium frondibus pinnatifidis pilosis; lobis semiovatis acutis."

"Polypodium asplenii folio villosa Pet. fl. 26. t. 7. f. 16.

"Habitat America meridionali."

"Affinitas hujus cum antecedenti suspecta est."—Linnaeus, l. c.

I do not list the many users of these two specific names, because all were citing names only, and none could know that the names were properly applied. I cite Swartz, because he dealt with *Polypodium suspensum* as a plant; but he modified Linnaeus' description by omitting the sole distinctive word, "glabris"; and may not be supposed to have dealt with the (non-existent) Linnaean plant. Witness Hieronymus, Bot. Jahrb. 34: 510: "P. suspensum Swartz.. (vix L. Spec. Plant. ed. I, p. 1084.)"

There exist no specimens which might have been the subjects of Plumier's plates. Nor has any botanist thought that he could recognize a species as distinctively the subject of plate 87;-cf. Hooker, Sp. Fil. IV 196: "Plum. Fil. p. 67, t. 87 (very bad, if really intended for this Fern)." Linnaeus himself evidently did not trust the plates,—"Affinitas hujus cum antecedenti suspecta est." I do not know what he meant by "affinitas," but will venture to translate it as identity.

Though the literature leaves us without any approach to certainty as to these two supposed species, there is evidence of another kind. According to Maxon, Pterid. Porto Rico p. 411, the plates which are the bases of both species were based on ferns from Martinique. The U. S. Nat. Herb. contains specimens from Martinique: *Duss* 1659; *Stehlé* 3313, 3321, 3434, 3443. The Univ. Calif. Herbarium contains a specimen received from Paris without name of collector, but looking like another duplicate of the Duss collection. These six sheets represent one species, and make me believe strongly that no other and similar species exists on that small island. It follows that Linnaeus' suspicion was correct, and that *Polypodium asplenifolium* is a synonym of *Polypodium suspensum*.

Description, based on the Martinique specimens:

Rhizome short-creeping or ascending, paleæ about 3 mm long, lanceolate or ovate, ferruginous or rusty-brown, freely setulose; stipe up to 20 cm long with lamina 45 cm, more commonly 5 to 8 cm long with lamina 30 to 40 cm, freely beset with castaneous horizontal setæ 3 mm long, more or less conspicuously recurved near the upper end; lamina 2.5–5.0 cm wide, acute or acuminate, the base abruptly acute with few reduced pinnæ, rachis setose, costae sparsely so, surface not quite glabrous, herbaceous, pinnate near base, elsewhere pinnatifid almost to the rachis; segments about 7 mm wide, rounded at apex or subacute, ciliate; sterile veins falling short of margin; sori medial, 5 to 10 in a row, sometimes apparently terminal but usually subterminal on the veins and then often on the acroscopic side of the vein; sporangia bearing plural setulae usually slightly longer than the diameter of the sporangium.

Specimens conforming to this description are common throughout the West Indies, and known on the continent from Mexico well into South America.

Polypodium Eggersii BAKER in Hooker's *Icones. Plant.* (1886)
Plate 1671.

Typified by *Eggers 937*, from Dominica. An isotype in the U. S. Nat. Herb. has three fertile fronds, but no adult and unbroken sporangia. I see no feature indicating that this is not a depauperate or juvenile *Ctenopteris suspensa*. Among other similar specimens are: From Martinique, *Duss 1658, 4115*, distributed as *Polypodium suspensum*, annotated as *Polypodium Eggersii*; from Guadeloupe, *Duss 4404, Stehlé 1206* annotated by Maxon as *Polypodium asplenifolium* juvenile, and *1414*; from Grenada, *Sherring s. n.* sterile; and from St. Kitts, *Britton & Cowell 509*, sterile. If these be recognized as all juvenile or depauperate individuals, their detailed distribution is without interest.

Cuba. The typical form of *Ctenopteris suspensa* occurs here, but more common in Province Oriente is a form with small fronds, about 15 cm long and 15 mm wide, with conspicuously curved slender stipes. The paleæ are brown (darker than typical), and the sori more constantly infraterminal on the veins. Setulæ on the sporangia are few, exceedingly fine, white or hyaline, hardly equalling the diameter of the sporangia. Examples are: *Clement 661, Hioram & Clement 6484, 6494, Leon, Clement & Roca 10149, Shafer 3378, 3890, 9005, Morton & Acuña 3145, 3195, 3223, 3654, 4510*. These may be a specific entity but I do not so treat them, partly because typical *Ctenopteris suspensa* is present with them: *Hioram & Clement 6492*,

Leon, Clement & Roca 10388, Ekman 6969, Maxon 4033, 4065. And there are some specimens: Ekman 5415, Leon 11100, Hioram 7051, Seifrizz 1089, which would be referred to the local form if it were formally distinguished, but are intermediate, at least in stature.

Jamaica. Exceedingly common, judging by the presence of 27 sheets in the U. S. Nat. Herb. The most of these are like the few Cuban specimens intermediate between the common small Cuban form and the typical *Ctenopteris suspensa* of Martinique. A few specimens have elongate creeping rhizomes, with distinct spaces between the stipes.

On the continent, *Ctenopteris suspensa* ranges from Mexico well into South America. Five Mexican sheets are from the base of Citlaltepētē, state of Vera Cruz. This is the type of locality of *Polypodium laxifrons* Liebm. Mex., Bregner (1849) 52, which seems to differ in no respect from *Ctenopteris suspensa*. It should be noted, though, that Liebm. reported *Polypodium suspensum* from Oaxaca.

There are numerous collections from Guatemala, Honduras and Costa Rica, which, except for very long stipes, are typical,—more so than most specimens from Cuba and Jamaica. This is true also of our three sheets from Panama.

The many collections from Colombia and Venezuela are partly long-stipitate, but a majority are typical in length of stipe. A local variation is a tendency of the fertile branch of the vein to be more evident.

Polypodium suspensum has been reported from Brazil and Ecuador, and we have specimens so named, perhaps correctly, from Bolivia; but we have no typical *Ctenopteris suspensa* from South of Trinidad, Venezuela, and Colombia.

Mexican specimens in hand are: Liebm. s. n. isotype of *Polypodium laxifrons*; Fendler 378, Pringle 8158, Fink 83, Purpus 212, 4374, Lauglassé 898.

2. *CTENOPTERIS EXORNANS* (Maxon) Copeland, comb. nov.

Polypodium exornans MAXON, Amer. Fern Jour. 18 (1928) 27.

This was originally described in great detail. The single clear-cut diagnostic feature is that the sporangia are "cinnamon-brown, each bearing a single griseous seta 3 to 5 times as long as the head of the sporangium." The paleae are darker than on typical *Ctenopteris suspensa*, but this is usually true of the *Ctenopteris suspensa* of Jamaica. In size and aspect,

Ctenopteris exornans is more like typical *Ctenopteris suspensa* than like the *Ctenopteris suspensa* of Jamaica.

JAMAICA, from Gossamer Peak, St. Thomas, alt. 750 to 900 m; *Maxon* 9185 (type). Other specimens are: *Maxon* 1016, 1541, 1911, 2250, 9116, 9130, 9382, 9479, 10547, *Maxon & Killip* 172, 781, *Fredholm* 3251, *Watt* 97.

3. *CTENOPTERIS CONTACTA* Copeland, sp. nov.

C. rhizomate breve paleis ciliatis 1 mm longis pallidis vestito; stipitibus confertis subsessilibus; laminis 30 cm longis vix 3 cm latis, deorsum angustatis brunnescentis, rhachidibus fere nigris setis pallidis onustis, segmentis oblongis arcte contiguis obtusis, rhachin secus non contiguis, herbaceis, facie superiore glabra inferiore margineque setosis, venis simplicibus; soris parvis medialibus, sporangiis setis longis plerisque solitariis vestitis.

BOLIVIA, Yungas, 1. *M. Bang* 483.

Remarkable for the intimate contact of the sides of the segments.

4. *CTENOPTERIS TAXIFOLIA* (Linnæus) Copeland, comb. nov.

Polypodium taxifolium LINNÆUS, Sp. Pl. (1753) 1086; *MAXON*, Pterid. Porto Rico (1826) 412; non *SWARTZ*, synopsis 35, nec *Lindmann*.

Polypodium venustum DESVAUX, Berlin Mag. 5 (1811) 315 (not seen).

Polypodium L'Herminieri FÉE, Genera (1852) 238.

"*Polypodium frondibus pinnatis; lobis approximatis ensiformibus parallelis acutis adscendentibus, radice hirta.*"

"*Polypodium taxi folio pendulum.* Pet. fil. 35 t. 14. 5. 1."

"*Polypodium tenue & pendulum.* Plum. amer. 69. t. 89."

"Habitat in America meridionali."—Linnæus, l. c.

"Rhizome short-creeping, 1-2 cm. long, 2-3 mm. thick, closely nodose, obscurely paleaceous; scales bright brown, rigid, deltoid-lanceolate, finely hair-pointed, entire, non-ciliate, 1½-2½ mm. long. Fronds several, closely distichous, suberect, 12-35 cm. long, the stipes 2-5 cm. long, dull brown. rusty-hispid; blades pinnatisect, linear to oblanceolate-linear, 10-30 cm. long, 2-3 cm. broad near the middle, tapering both ways, acute or acuminate at apex, usually subtruncate at base, the small lowermost segments subdistant; rachis sparsely castaneous-setose beneath, densely so above, segments alternate, horizontal, linear, 1-1.5 cm. long 2-3 mm. broad, roundish at apex, fully adnate, close, with rounded narrow sinuses, thin-herbaceous, translucent, glabrous above sparsely castaneous-setulose beneath and along the sub-revolute entire margins; costæ fuscous, flexuous, evident; veins 6-10 pairs, simple, short, spreading, distant; sori small, terminal, nearly equidistant from the costa and margin."—*Maxon*, l. c.

A species could hardly be more diversely construed than has been *Polypodium taxifolium*. To bring at least similarity, with some approach to identity, into the "species," I have accepted

as *Polypodium taxifolium* the plant so named by Maxon and described above. This excludes all plants with forked veins, which are the *Polypodium taxifolium* of Lindmann, and, according to him, of Swartz.

Specimens so included are: PORTO RICO, Hess 242, Britton & Brown 5419, Shafer 3620, Sargent 306, Wagner s. n. HISPANIOLA, Ekman 371, 5449, 12710. MARTINIQUE, Stehlé 3412, 4970, Duss 1575, 1674, 4573. GRENADA, Eggers 6184, Broadway s. n., Box 270. Murray & Elliott s. n. TRINIDAD, Broadway 5966, 6183, Hombersley 80. SURINAM, Maguire 24568. BRAZIL, Smith 1957 (approximately).

From Costa Rica to Bolivia, specimens have been distributed as *Polypodium taxifolium*, none of which conform exactly to the description based on West Indian plants.

5. CTENOPTERIS LEHMANNIANA (Hieronymus) Copeland, comb. nov.

Polypodium lehmannianum HIERONYMUS, Bot. Jahrb. 34 (1904) 513, non *P. Lehmannii* METTENIUS, Pol. (1857) 117, Plate 3, fig. 35.
Polypodium pastense C. CHR., Index (1906) 551.

"Eupolypodium; rhizomatibus breviter repentibus, usque ad 3 mm crassis, paleis dense obtectis; paleis subferrugineis, . . . c. usque ad 4 mm longis, basi vix $\frac{3}{4}$ mm latis . . . ubique setulis usque ad 0.12 mm longis sparse obtectis . . . petiolis usque ad 2 dm longis, usque ad 1½ mm basi crassis . . . setis ferrugineis usque ad 3 mm longis . . . subdense ubique obtectis; laminis flexuosis, usque ad 4½ dm longis, 8 cm supra basi latis, linearibus vel lineari-oblongis, basi vix angustatis, profunde . . . pinna-tipartitis . . . ; costa utrinque setoso-villosa, . . . fuscescens; . . . segmentis alternis, e basi dilatata elongato-deltaideis, acutis, patentibus, rectis vel subfalcatis, supra sparse, subtus parum densius hirsuto-pilosis, membranaceis vel tenuiter chartaceis . . . c. 4 cm longis, fere 1 cm basi latis; . . . venis lateralibus alternis, non perspicuis mesophyllo immersis, simplicibus . . . fertilibus infra medium fusiformi-incrassatis hic sorum gerentibus; sori . . . costæ magis quam margini approximatis, rotundis, vix ultra 1 mm diametientibus, sporangia c. 25-30 villis sæpe carentia vel rarius villis 1-2 usque ad 0.3 mm longis instructa gerentibus, in segmentis maximis usque ad 12-13-jugis."

COLOMBIA: W. side of Cordillera de Pasto, alt. 1,000 to 1,300 m. *Lehmann* 19; ECUADOR, *Struebel* 1011.

Related to *Polypodium arcuatum* Moritz and *Polypodium dolorense* Hieron.

6. CTENOPTERIS CHRYSLERI (Proctor) Copeland, comb. nov.

Polypodium Chrysleri PROCTOR, Checklist Jam. Pterid. (1953) 48.
Polypodium arcuatum MORITZ; METTENIUS, Pol. (1856) 56; C. CHR., Kungl. Svenska Vetenskapad. Handl. III 16 (1936) 70
nomen nudum et invalidum.
Polypodium suspensum HOOKER, Sp. Fil. IV (1862) 196 *partim*, non L.

C. suspensæ affinis, rhizomate brevi-repente, valido, paleis 1–2 mm longis lanceolatis castaneis ciliatis permultis vestito; stipitibus approximatis, 15 cm longis, 1.2 mm crassis, setis brunneo-rubidis 2 mm longis vestito; lamina usque ad 50 cm longa, 8 cm lata, basi abrupte contracta (nec truncata), vix ad rhachin pinnatisecta, rhachi nigra setosa; segmentis medialibus 4 cm longis, basi dilatato 1 cm lato, deinde ad apicem acutum gradatim angustatis, herbaceis, ciliatis et ad superficiem sparse setosis; veinis aut subconspicue aut inconspicue furcatis; soris medialibus, sporangiis setis quam diametro sporangii multo longioribus obsitis.

JAMAICA, *Maxon 1524* (type), in U. S. Nat. Herb. *Fendler 213*, from Venezuela, Colonia Tovar, is identical except for shorter laminæ.

On the type, I detect few sporangia with setæ more than twice their diameter. Of other specimens referred here, some have setæ up to three times the diameter, others have them only one and a half times as long. Setulæ usually occur on the surface as well as on the margin of the paleæ. Specimens vary also in the pubescence of the lamina, but none are glabrous. On the whole, if I treat these specimens correctly as representing one species, it is a variable one. Superficially it is well marked by the form of the segments, uniformly narrowed from just above the dilated base to the acute apex, thus being very narrowly triangular.

Specimens: JAMAICA, *Maxon 2778, 2786*. HISPANIOLA, *Ekman 6451, 7374, 12018*. COSTA RICA, *Standley 33630a* (No. 33630 has naked sporangia). PANAMA, *Goldmann s. n., Williams 846*. VENEZUELA, *Pittier 100043*. COLOMBIA, *Schultes & Smith 12549*. BOLIVIA, *Buchtien 5252*.

7. *CTENOPTERIS DOLORENSIS* (Hieronymus) Copeland, comb. nov.

Polypodium dolorens HIERONYMUS, Bot. Jahrb. 34. (1905) 512.

Rhizome stout, paleæ ferruginous, finely ciliate and sparsely irregularly toothed; stipes in our specimens 15 cm, but described as 25 cm long, hairy; lamina in our specimens 30 cm, but described as 75 cm long, not quite pinnate; segments elongate-deltoid, 3 to 4 cm long, almost 1 cm broad at the base, not dilated, glabrescent above, rather densely beset beneath with dark setulæ; sori large (2 to 2.5 mm in diameter), inframedial as to the lamina, the veins sometimes visible beyond the sori

and the sori then evidently on the acropetal side of the veins; sporangia bearing setulae 2 or 3 times their diameter.

COLOMBIA, from Santa Rosa, Prov. Antioquia, Columbia, alt. 1,700 to 2,200 m; *Lehmann 7380* (type), isotype in U. S. Nat. Herb. In hand are also *Killip & Smith 19283*, *Henri-Stanislas 1597*, both from Colombia, and agreeing with the description except in stature.

The setulose nether surface and long-setulose sporangia are peculiar features, insuring the identification.

8. *CTENOPTERIS TRUNCORUM* (Lindman) Copeland, comb. nov.

Polypodium Truncorum LINDMAN, Hedw. 43 (1904) 309.

Polypodium Bakeri LINDMAN, Ark. vör Bot. 1 (1903) 240, Plate 11, fig. 9, non Lueres.

"Eupolypodium lamina pinnata more Polyp. pectinati, prope accedens ad *Pol. gratum* Fée, Fil. Brasil., t. 76, f. 2. a quo differt forma pinnarum et directione venularum.

"Stipes curvatus, villosiusculus; lamina lineari-lanceolata, membranaceo-herbacea; pinnæ multijugae, paulum porrectae neque horizontales, lineari-lanceolatae vel ensiformes sensim ad apicem angustatae, 3 cm longae, infimae reductae, omnes subacutae, margine aculeato-setulosae, basi margine posteriore paulum decurrente, vena primaria flexuosa, venulae simplices porrectae, in media fronde 12-14-jugae pro pinna; sori submarginales in apice suae cujusque venulae.

"Brasil., Minas Geraes, Pedra Branca, in caudice filicis, Regnell II. 319 * a, b."

"Syn. *Pol. pectinatum* var. *Glaziovii* Bak. in sched. Herb. Stockh."—Lindmann, Ark. v. Bot.

Paleae of the rhizome small, deltoid, entire; stipes articulate to rhizome, 2 to 6 cm long, pubescent, then glabrescent; rachis densely minutely pubescent; pinnæ contiguous, dilated at base, thence narrowed gradually to acute apex, sparsely minutely ciliate, thin; first acropetal vein forked, others simple, almost invisible; sori slightly supra-medial. Sporangia naked.

Isotype in Herb. Univ. Calif. Others in Herb. Univ. Calif.: *Luetzelburg 7218, 13108, Wacket 41, Leite 3562, Jönsson 744a*; in U. S. Nat. Herb.: *Smith & Brade 2195, Brade 6522, Dusen 3651, 9913, Wacket 108*.

9. *CTENOPTERIS SEMIHIRSUTA* (Klotzsch) Copeland comb. nov.

Polypodium semihircutum KLOTZSCH, Linnaea 20 (1847) 379.

Polypodium gratum FÉE, Crypt. Vasc. Bras. I (1869) 242, Plate 76, fig. 2.

Polypodium pectinatum var. *hispida* CHRIST, Prim. Fl. Cost. 3 (1901) 15.

Polypodium leucolepis GILBERT, Bull. Torr. Bot. Club 24 (1897) 260.

Polypodium taxifolium AUCT., non Linn.

"Caudice crasso, repente, paleis castaneis, nitentibus radicibusque villosis, ferrugineis dense vestito; frondibus pinnatifidis, oblongis, utrinque attenuatis, longe stipitatis; laciniis lanceolatis, acutis, horizontalibus, utrinque glabris, superioribus approximatis, inferioribus remotis, multisoris; soris parvis, lacte-fuscis ad marginem approximatis, ad paginam superiorem leucostichis; stipite tereti, elongato, fusco, subnitido, evanescenti-piloso; rhachi in pagina superiore hirsuta, in pagina inferiore glabra."

"Caudex crassus, ferrugineo-vellereus. Stipes 4-6 pollicares longus, crassitudine pennæ anserinæ. Lamina frondis 9-16 poll. longa, 1-2½ poll. lata. Laciniæ 8-15 lin. longæ, subulatæ, ad basin 2 lin. latæ."

"In Peruviae Andinum nemoribus Panatahuas Provinciae."—Klotzsch, l. c.

The original descriptions of *Polypodium semihirsutum*, *Polypodium gratum* and *Polypodium leucolepis*, all mention the lime-dots on the upper surface.

There is wide variation in the pubescence of the lamina. Because it has been treated as distinct, I let *Polypodium oreophilum* so stand.

Isotypes of *Polypodium semihirsutum* and *Polypodium gratum* in U. S. Nat. Herb. are enough to alike to be one collection.

Other collections are: BOLIVIA, Buchtien 5271; PERU, Macbride 4294, Osgood & Anderson 51, Bues 1929; ECUADOR, Sodiro s. n., Rimbach 69, 113, Lehmann LXXV, Rose & Rose 23460, Popenoe s. n., Tate 488, Mille 13, Mexia 7013, Wiggins 21; COLOMBIA, Lehmann 1211, 5055, Pittier 1148, Killip & Hagen 10133, 11140, Killip & Garcia 33706, 33778, Killip & Smith 15885, 16041, 17836, 18705, 19202, 19999, Pennell 4400, 9259, Ariste-Joseph s. n., Daniel 3950, Cuatrecasas 18882, Juzepczuk 6573; Roraima Exped. s. n. COSTA RICA, Standley 39185, Standley & Valerio 43957, Valerio 235; GUATEMALA (var. *fuscocetosa*), Donnell Smith 3256; MEXICO, Matuda 2879; JAMAICA, Hart 37, Sherring s. n. Underwood 1466, 1505, Maxon 1374, 1431b, 9766, 9855, 9917, 9989, Maxon & Killip 1100; HISPANIOLA, Ekman 1401, 7685, 7806.

Four collections from Panama, Maxon 5481, 5637, 7879, Killip 5300, have non-ciliate paleæ, but are otherwise more like *Ctenopteris semihirsuta* than *Ctenopteris taxifolia*. They can or might be regarded as a distinct species.

Polypodium semihirsutum var. *fuscocetosa* Hieronymus, Engler's Jahrb. 34 (1904) 515, "differt a forma typica rhachibus

in pagina superiore hirta nec hirsuta, in pagina inferiore plus minusve dense fusco-vel subnigrescenti-hirto-setosa nec glabra." Its cited range is from Peru to Guatemala. The species is variable in pubescence, and I do not see that this "variety" is notably distinguishable.

10. *CTENOPTERIS STELLA* Copeland, sp. nov.

Rhizomate breve adscendente, paleis inconspicuis ciliatis; stipite ca. 2 cm longo, 1 cm crasso, pilis 3 mm longis dense obsito; laminis pendentibus 40–60 cm longis, rhachibus pilis multis simplicibus ferrugineis, nonnullisque fuscis, cellulis basalibus vix 1 mm longis et radiis capitalibus 3–6 compositis; pinnis contiguis, usque ad 6 cm longis, rhachin secus subdilatatis, deinde ca. 5 mm latis, integris, utraque facie setulosis, herbaceis; venis simplicibus fere horizontalibus; soris medialibus usque ad 17-paribus, magnis, sporangiis setulis pallidis obsitis.

PERU, valley of Rio Urubamba, Dept. of Cuzco, *Bues A. 32* (type). *Bues A. 27*: ECUADOR, *Sodirol s. n.*: COLOMBIA, *Lehmann 3466*.

11. *CTENOPTERIS VERNICOSA* Copeland, sp. nov.

Plate 9.

Polypodium vernicosum MAXON in Herb.

Rhizomate erecto, apice paleis densis lineari-aciculatis 8 mm longis vestito; stipitibus fasciculatis, 4–7 cm longis, 1 mm crassis, nigris, setis 1–1.7 mm longis dense vestitis; lamina 15–20 cm longa, basi vix angustata, medio longitudine pinnata rhachi nigra; pinnis vix 2 cm longis, 2.5 mm latis, obtusis, integris, inferne sparse setosis, superne vernicosis coriaceis; venis invisis; soris medialibus, superficialibus, sporangiis glabris, soris globosis.

COSTA RICA, Alto de la Estrella, Prov. Cartago, *Standley 39140*. COLOMBIA, *Pennell & Killip 6638*: ECUADOR, *Rimbach 303*.

GROUP OF *CTENOPTERIS* SERICEO-LANATA

Key to the species

Fronds densely hairy.

- | | |
|--------------------|-----------------------------|
| Pinnæ obtuse | 1. <i>C. sericeo-lanata</i> |
| Pinnæ acute | 2. <i>C. longa</i> |

Fronds not dense hairy.

- | | |
|----------------------------|------------------------|
| Fronds closely pectinate. | |
| Rachis naked beneath | 3. <i>C. oreophila</i> |

Fronds loosely pectinate.

Fronds linear 4. *C. Pichinchæ*

Fronds broader.

Pinnæ lanceolate or linear.

Stipes short (under 5 cm).

Stipes velutinous 5. *C. major*

Stipes over 5 cm long.

Fronds long-attenuate downward.

6. *C. attenuatissima*

Fronds short-attenuate 7. *C. longiuscula*

Pinnæ oblong 8. *C. fabæspora*

1. *CTENOPTERIS SERICEO-LANATA* (Hooker) Copeland, comb. nov.

Polypodium sericeo-lanatum HOOKER, Sp. Fil. IV (1862) 221.

"Caudex creeping clothed with subulate brown wooly scales, stipites aggregated 1-2 inches long sericeo-villose, fronds 6-12-16 inches long 1½-3 inches with flaccid pendent firm-membranaceous clothed with silky whitish wooly hairs broad oblong-lanceolate or oblong-acuminate pinnate, pinnæ 1-2 inches long ¼ of an inch broad oblong or linear-oblong alternate approximate from a rather broad base more or less decurrent below adnate more or less tapering to an obtuse point straight or falcately recurved rarely with a blunt auricle or lobe above and more rarely one below also, when the pinnæ become subhastate, quite entire, costae slender straight appearing black when viewed between the eye and the light, veins short rather distant simple indistinct bearing the sorus at the apex in two series nearer the costule than the margin, sori globose, rachis filiform flexuose."

"Hab. Ecuador, Pichincha, alt. 12,000 feet, and woods near Baños, Jameson, n. 235, 73, 29, and 394 . . ."—Hooker, l. c.

Paleæ about 2 mm long, narrowly lanceolate, ciliate. Frond variable in length, 15 to 60 cm long, lanceolate or linear, base sometimes very long-attenuate downward, stipe up to 15 cm long or no more than 1 cm, hirsute, rachis and surfaces densely hirsute concealing the sori; sporangia densely hairy.

ECUADOR, *Jameson 235: BAÑOS, Jameson 29, Camp E-5164: ECUADOR, Andre 2196, Rimbach 33, Mille 1, s. n., Lehmann 7656, Steyermark 53415, Wiggins 10768: BOLIVIA, Herzog, Cardenas 3149, Williams 259: PERU, Bues 1930, Bryan 625, Macbride 4303: COLOMBIA, Ariste-Joseph s. n., Killip & Smith 17751, 18608, Killip & Hazen 9446, Cuatrecasas 11922, 18921, 20046. Andre 2196, Rosenstock (Rimbach) 33: COSTA RICA, Valerio 26. MARTINIQUE, Duss 1657, 4572, 4384, 4403.*

2. *CTENOPTERIS LONGA* (C. Chr.) Copeland, comb. nov.

Polypodium longum C. CHR., Index (1906) 541.

Polypodium alternifolium HOOKER, Sp. Fil. IV (1862) 222, Plate 277 A., non Mett.; Sodiro.

"Caudex?. Stipites aggregated 1-1½ inch long slender clothed as is the whole plant with spreading soft silky hairs, fronds 2-3-10 feet (!) long lax and flaccid-membranaceous pendent linear shortly acuminate moderately attenuated at the base pinnated throughout in the most regularly alternate manner, pinnae distant, horizontal long ciliated one inch long almost exactly pyramical that is from a broad adnate base ¼ of an inch wide quite entire gradually tapering to a moderately acute point the sides uniform and equal or with the upper base only slightly rounded no way decurrent, pinnae at the apex and base small triangular, costule very slender black when viewed between the eye and the light flexuose, veins quite slender black patent always simple bearing the globose sorus at the apex rather nearer the costule than the margin, rachis filiform flexuose."

"Hab, Ecuador, occurring abundantly on the trunks and branches of trees at elevations of 3,000 and 10,000 feet . . . Jameson, Hartweg, n. 1496 . . ."—Hooker. l. c.

Paleae ciliate, 2 mm long; sporangia setulose.

Characterized by indefinitely long fronds, the pinnae equal-sided at base, fully adnate, not decurrent, the fronds therefore pinnate throughout.

Said to occur over an altitudinal range from 3 to 10 thousand feet (Hooker), from 400 meters up the limit of perpetual snow (Sodiño, Crypt. vasc. Quit. 321). By itself, such a range in altitude suggests a confusion of species, and it may be noted that Hooker published the species "with some doubt."

Specimens ascribed to *Ctenopteris longa* are: from ECUADOR, Sodiño s. n., Mille 11, 382 and s. n. "per totam Ecuador, 400-4000 met. in Monte Pichincha," Rimbach 126 partim; COLOMBIA, Ariste-Joseph A 526, Appollinaire 18; PERU, Bues 967, 1007, 1031, 1953; BOLIVIA, Williams 1308, Bang 556, Buchtien 525; COSTA RICA, Werkle 571, Maxon & Harvey 8183, Standley 38713.

Sporangia with many short setulae. Pedicel (at least of Costa Rica plants) one row of cells. Spores of South American specimens oblong; of Costa Rican, probably tetrahedral, but very few seen.

3. CTENOPTERIS OREOPHILA (Maxon) Copeland, comb. nov.

Polypodium oreophilum MAXON, Cont. Gray Herb. 165 (1947) 72.

"Subg. Eupolypodium. Rhizoma repens, 2-4 cm. longum, parce ramosum, 2-3 mm. diam., ubique dense comoso-paleaceum, paleis numerosissimis, acervo incano-brunneis, deltoideo-linearibus, ca. 6 mm. longis, basi 0.5-0.7 mm. latis, longissime attenuatis, subflexuosis, basi subcordata incrassata firme affixis, clathratis (parietis exterioribus hyalinis, transversalibus brunneis, ca. 18 μ crassis), copiose ciliatis, ciliis incanis, rigidis, ca. 0.2 mm. longis. Folia multa, fasciculata, erect, 25-30 cm. longa; stipites 2-5 cm. longi, aequaliter 0.7 mm. diam., brunnei; ubique minute

et dense incano-hirtelli, pilis rectis, ca. 0.2 mm. longis; Laminæ lineares, ca. 25 cm. longae, medio 3-4 cm. latae, utrinque attenuate, pinnatae, rhachi utrinque atrofusca, supra lense griseo-hirtella, infra fere glabra; pinnæ 75-85-jugæ, confertæ (sinubus angustissimis), patentēs vel leviter obliquae, lineares, majores 1.5-2.3 cm. longae, medio 2-3 mm. latae (basi leviter decurva 2.5-4 mm. latae), ultra medium modice angustatae, apice ipso rotundae, integrae, membranaceo-herbaceae, fere glarae (subtus pilis glandulosis furcatis fuscis dissitis minutissimis instructae), costis tenuibus, fuscis supra modice elevatis, infra subimmersis; venæ 11-14-juage, simplices, obliquae (40°), hydathodis subrotundis vel ellipticis margine remotis terminatae; sori apice venarum siti, rotundi, superficiales, ca. 1 mm. diam.; sporangia annulo articulis 12 formato cincta, sporis triplanatis globosis, papillosis, ca. 32 μ diam."

Type: *Haught 1959*: Colombia, Dept. Santander, alt. 1,200 to 1,500 m.

Other species with grayish-ciliate paleæ are *Polypodium Stübelii* and *Polypodium apiculatum*. A specimen from Porto Rico probably belongs here.

4. *CTENOPTERIS PICHINCHAE* (Sodirol) Copeland, comb. nov.

Polypodium Pichinchæ SODIROL, Crypt. Vasc. Quit. (1893) 329.

Polypodium subscabrum HOOKER, Sp. Fil. IV (1862) 183, Plate 274 A. non Kl.

Polypodium pichinchense HIERONYMUS, Bot. Jahrb. 34 (1904) 506.

Polypodium ecuadorensis C. CHR., Index (1906) 504.

"P . . . rhizomate ascendente, gracili, squamis lanceolatis, acuminatis, ciliatis ad apicem imbricato; stipitibus fasciculatis, cylindricis, rigidis, patenti-hirtellis; frondibus lanceolatis, utrinque gradatim angustatis, 25-30 ct. longis, 2-3 ct. latis, papyraceis, pallide viridibus, supra subglabris vel glabrescentibus, subtus rachibusque elasticis, utrinque pilis nigris, setulosis conspersis; pinnis alternis, sessilibus, triangulari-lanceolatis, integris, acutis, 1-1½ ct. longis, 3-5 ct. latis, basi utraque rachi adnata, sinu acuto sejunctis; inferioribus sensim minoribus, infimis auriculiformibus; venis rachibusque nigris, venulis obliquis, indivisis, utrinque 7-10, longe intra marginem desinentibus; soris nervo medio approximatis."—Sodirol, l. c.

ECUADOR, on the East side of Mt. Pichincha, Stipes 3 to 6 cm long.

5. *CTENOPTERIS MAJOR* Copeland, sp. nov.

Plate 10.

Polypodium tenuiculum var. *acrosora* HIERONYMUS, Engler's Jahrb. 34 (1904) 511, non *Polypodium acrosorum* Kze.

C. rhizomate adscendente vel erecto, paleis longis lanceolatis ciliatis vestito; stipitibus fasciculatis, 3-5 cm longis, minute pubescentibus; lamina ca. 30 cm longa, 2½-4 cm lata, caudata,

basi attenuata, pinnata, subcoriacea, fusca, rhachi superne pubescente excepta glabra; segmentis contiguus, vix 3 mm latis, integris; venis simplicibus, inconspicuis; soris supramedialibus, superficialibus; sporangiis nudis, annulo 12–16-cellulare, sporis triletis.

ECUADOR, Cuenca; Cordillera Occidental, alt. 2,500 to 2,900 m, *Lehmann* 5727. The field note describes the color as bluish green.

The U. S. Nat. Herb. contains two sheets of the type collection. As compared with *Ctenopteris tenuicula*, this species is larger, firmer, darker, more caudate, more completely pinnate, with almost invisible veins. The two species do not seem to be intimately related.

6. CTENOPTERIS ATTENUATISSIMA Copeland, sp. nov.

Plate 11.

C. rhizomate breve 3–4 mm crasso, paleis atrocastaneis 2–4 mm longis angustis minute ciliolatis vestito; stipitibus 6–10 cm longis, 1 mm crassis, pilis pallidis $1\frac{1}{2}$ mm longis vestitis; lamina ultra 35 cm longa, $2\frac{1}{2}$ –4 cm supra mediam lata, deorsum longissime attenuata, ad rhachin tantum pinnata, rhachi inferne nigra minute nigro-setulosa, superne glabra; pinnis 2 mm latis, obtusis, tenuiter coriaceis, glabris, marginibus integris plus minusve deflexis, costis nigris; venis simplicibus; soris submarginalibus parvis, facie superiore laminæ squamis calcareis prædita; sporangiis nudis, annulo 12-cellulare, sporis triletis.

ECUADOR, Mt. Tungurahua, 1. Sodiro. Type in U. S. Nat. Herb., No. 1431876, received from Mus. Paris. as *Polypodium taxifolium*. The nearer affinity is to *Ctenopteris semihirsuta*.

SODIRO, Crypt. Vasc. Quit. 330, included several species under *Polypodium taxifolium*, even, as a variety, *P. filicula* Kaulf. *Ctenopteris attenuatissima* might be included under the terms of his Spanish text, but hardly under his Latin.

Rimbach 22 and 113a are approximately *Ctenopteris attenuatissima*.

7. CTENOPTERIS LONGIUSCULA (C. Chr.) Copeland, comb. nov.

Polypodium longiusculum C. CHR., Index (1905) 188,—substitute name.

Polypodium leucosticta FÉE, Genera (1850–'52) 240, non Kl.

Ctenopteris leucosticta J. SMITH, Hist. Fil. (1875) 185.

“Frondibus pendulis, linearibus, pilosis, pilis rufescentibus; stipite filiformi, cylindrico; segmentis obtusis, lanceolatis, nervillis brevibus, simplicibus; mesoneuro flexuoso, nigrescente, ad apicem evanescente; sporo-

theciis subsenis, rotundis, inferne laminam inquinantibus; receptaculo nullo; sporangiis ovoideis; annulo crasso, inaequali, 14-15 articulado; sporis rotundatis, sporulis minutissimis repletis."

"Habitat in Quito. (Jameson.)"

"Filix longiuscula, flexibilis, angusta, pilis rufis cooperta."

"Dimensions: longueur totale, 30 centim., sur 22-24 millim. d'envergure; nous comptons de 45-50 segments, remarquables par les points blanc de neige, qu'ils portant en dessus et qui correspondent aux sporothecae . . ."
—Fée, l. c.

Specimens in U. S. Nat. Herb. by *Jameson, Sodiro, Rimbach 22, 113a*, and *Mille*, from Ecuador; from Peru, *Osgood 83*.

9. CTENOPTERIS FABÆSPORA Copeland, sp. nov.

C. rhizomate breve adscendente paleis 3 mm longis vix 1 mm latis fuscis pilis pallidis minutis ciliatis vestito; stipitibus 2-5 cm longis caespitosis, setis 1 mm longis pallidis permultis obsitis; lamina pendente 20-40 cm longa, 4 cm lata, utrinque set abrupte angustata, tantum pinnata, rhachi pilis parvis vestita; pinnis approximatis, patentibus, obtusis, inferne minute pubescentibus, decidue ciliatis, herbaceis; venis simplicibus; soris ad venas terminalibus, medialibus, superficialibus; sporangiis setulis usque ad 8 ornatis, spris plerisque (omnibus?) biletis.

PANAMA, "humid forest between Alto de las Palmas and top of Cerro de la Horqueta, Chirique, alt. 2,100 to 2,268 meters." *Maxon 5499*, March, 1911. Three sheets in U. S. Nat. Herb. Also, *Maxon 5633*, alt. 1,650 to 1,925 m; also *Killip 5307*, 10 miles above El Boquete, alt. 1,900 to 2,100 m.

There seem to be some trilete spores, but most of them are certainly fabiform. By all other criteria, this fern is clearly a *Ctenopteris*.

GROUP OF CTENOPTERIS MERIDENSIS

(Base of lamina truncate)

Key to the species

Pinnæ under 3 mm wide.

Paleæ setulose 1. *C. semiadnata*
Paleæ entire *C. aromatica*

Pinnæ over 3 mm wide.

Fronds including stipe under 10 cm long.

Fron linear-lanceolate 3. *C. patentissima*
Fron lanceolate 4. *C. ambigens*

Fronds larger.

Lowest pinnæ serrate 2. *C. longipinnata*

No pinnæ serrate.

Segments triangular-acute.

Nether surface freely setose..... *C. dolorensis*

Nether surface sparsely setose.

Fronds over 60 cm long..... *C. lehmanniana*

Fronds under 50 cm long..... *C. Maxonii*

Segments not triangular-acute.

Lamina linear 5. *C. Mayoris*

Lamina broader.

Frond dark-green.

Frond herbaceous 6. *C. atroviridis*

Frond coriaceous *C. vernicosa* "7"

Frond not dark.

Sporangia setose.

Stipe as long as lamina.

7. *C. longisetulosa*

Stipe shorter than lamina..... *C. exornans*

Sporangia naked.

Frond broadly triangular.. 13. *C. Kalbreyeri*

Frond longer than broad.

Stipe longer than lamina.

Rachis sparsely pubescent.

8. *C. Kookenamæ*

Rachis densely pubescent.

9. *C. nudicarpa*

Lamina longer than stipe.

Paleæ entire..... 4. *C. ambigens*

Paleæ ciliate.

Lamina pinnate at base.

10. *C. Fendleri*

Lamina truncate at base.

11. *C. subimpressa*

Lamina pinnatisect.

12. *C. meridensis*

1. CTENOPTERIS SEMIADNATA (Hooker) Copeland, comb. nov.

Polypodium semiadnatum HOOKER, Ic. Pl. (1854) Plate 948; Sp. Fil. IV 222.

"Caudex small short ferruginous villose, stipites 1-2-3 inches long filiform black and patenti-villous as is the rachis, fronds pendent coriaceo-membranaceous 10-16 inches long $\frac{1}{2}$ -1 inch wide linear-oblong acuminate attenuated below pinnated, pinnæ rather distant ovate or oblong-ovate obtuse or rarely acuminate villous beneath and ciliated with long hairs at the margin crenate or obtusely serrated the base contracted and above a little produced, costule slender and forked, veins moderately conspicuous, superiore branch soriferous, sori four or five on each side the costule between it and the margin."

"Hab. on trunks of trees, Philzhum, and near Pasto, Andes of Quito, Jameson, n. 46, 77, and 498. Organ Mountains, Brazil, on trees Gardiner, n. 112, Rio, Brackendrige. The great peculiarity of this *Polypodium*, among the group to which it belongs, is the length of the very flaccid

frond, and the numerous, and large pinnæ (sometimes more than $\frac{1}{2}$ an inch long), and the contraction where they join on to the rachis . . . Allied . . . to some forms of *P. cultratum*."—Hooker, Sp. Fil.

The expression "coriaceo-membranaceous" and the citation of specimens from as wide a range as Ecuador and Rio make it probable that more than one species was included by Hooker. I have seen no Jameson collection, of which No. 46, from Ecuador, should be the type; but do have, from Ecuador, *Sodirol s. n.*, *Mille s. n.*, and *Holmgren 902*, all more or less coriaceous. The Brackenridge collection, from Rio, is thin, and does not represent this species.

Amplifying the description of the Ecuador species, the real *Ctenopteris semiadnatum*: Paleæ 3 mm long, atrocastaneous, ciliate; stipes wiry, glabrescent; lamina up to 50 cm long, 2 cm wide, attenuate to both ends, pinnata, rachis moderately setose; pinnæ ovate, 4 mm broad above the base, crenulate, fully adnate, not confluent, coriaceous, ciliate, and with sparse hairs on the surface; veins mostly forked; sori medial, superficial, becoming crowded; spores trilete-globose, annulus of about 14 cells.

2. *CTENOPTERIS LONGIPINNATA* Copeland, sp. nov.

Plate 12.

C. grandis, rhizomate invisio; stipite nigro, deorsum glabro; lamina 30 cm longa, 8–10 cm lata, brunneo-viride, basi truncata, subpinnata, rhachi ferrugineo-pilosa; pinnis fere horizontalibus, subarcuatis, supra basin dilatatum 4 mm latis, deinde ad apicem acutum angustatis, pilis brevibus sparsis ciliatis, aliter glabris, coriaceis, inferioribus grosse serratis; venis furcatis ramulis ambabus elongatis; soris supramedialibus, ad venulas acroscopicas terminalibus, sporangiis nudis, annulo 14 (–15)–cellulare, sporis triletis.

PERU: Cabecera del Koribeni, alt. 9,300 ft; *Bues 1952*, type; also, Valle de Lares, alt. 9,000 ft, *Bues 1793*.

3. *CTENOPTERIS PATENTISSIMA* (Mettenius) Copeland, comb. nov.

Polypodium patentissimum METTENIUS apud KUHN, *Linnaea* 36 (1869) 134.

"Rhizoma crassitiem pinnæ corvinae non adaequans, elongatum paleis paucis, remotis sparse obsitum, mox denudatum; folia distantia, membranacea, glaberrima; phyllopodium vix 1" altum; petiolus 1" longus; lamina 6–10" longa, 1–2" lata, elongata, acuminata, profunde pinnatipartita; laciniae numerosae patentissimae, elongatae apice sensim attenuatae, subrepandae, contiguæ inferiores basi superiore adscendente adnatae,

infirmæ deflexæ, vix abbreviatae; nervi anadromi, obliqui, steriles indivisi, fertiles furcati, ramulo antico sorifero brevissimo; sori medii inter costulam et marginem."

"Chimborazo, alt. 3,000 ped. (Spruch 5713)."

"*P. tenuifolio proximum*, glabritie rhizomatis insigne."—Mett., l. c.

POLYPODIUM PATENTISSIMA Mettenius Kuhn.

Polypodium Manabyanum BAKER, Jour. Bot. 15 (1877) 165.

"Rhizome half a line thick, firm, flexuose, wide-scandent (in one of our specimens above a foot long), naked. Stipes distant, naked, stramineous, half an inch long. Frond lanceolate, 8–12 inches long, 1–1½ inches broad, erect, cut down to the midrib into lanceolate patent acute crenulate pinnae ½ in broad, all contiguous and broadly adnate at the base, a few lower ones dwarfed and deflexed. Texture moderately firm; both surfaces green and glabrous, and veins distinct, simple, erecto-patent, 8–10-jugate in the largest pinnae, not reaching more than halfway to the edge. Sori small, round, superficial, placed nearer the midrib than the margin of the pinnae. Near *Polypodium taxifolium*, Linn."—Baker, l. c.

The paper is on a collection sent by Sodiro.

4. CTENOPTERIS AMBIGENS (Maxon) Copeland, sp. nov.

Plate 13.

Polypodium ambigens MAXON in herb.

Ctenopteris gracilis rhizomate parva, paleis atrocastaneis 1.5 mm longis lanceolatis integris vestito; stipitibus 5–10 cm longis, nigris, filiformibus, setosis setis 1.5 mm longis; lamina 10–15 cm longa, 2–2.5 cm lata, acuta, deorsum late rotundata, profunde pinnatifida, rhachi nigra fere glabra; segmentis, fere contiguis, oblongis, 3–4 mm latis, apice rotundatis, integris, sparse setiferis, venis aut simplicibus aut furcatis; soris medialibus, superficialibus, sporangiis nudis.

COSTA RICA, Volcan de Turrialba, alt. 2,000 to 2,400 m, *L. Standley* 35215, type. Also, 35051.

Near to this, and possibly identical, is *Barriga* 11109, from Colombia.

5. CTENOPTERIS MAYORIS (Rosenstock) Copeland, comb. nov.

Polypodium Mayoris ROSENSTOCK, Mém. Soc. Neuchateloise 5 (1912) 53, Plate 4, fig. 6.

Rhizome short, erect, palæ lanceolate-attenuate, atrocastaneous and nigrescent, ciliate; stipe 5 cm long, densely short-pilose; lamina 15 cm long, 2 cm wide, truncate at base, gradually attenuate upward, otherwise uniformly narrow, pinnatisect or the lowest segments free, rachis black, densely pubescent; segments 3–4 mm wide, obtuse, the sides deflexed, coriaceous,

ciliate and nether surface sparsely setose, fertile veins forked; sori medial, becoming confluent, sporangia naked, spores tetrahedral.

COLOMBIA: Antioquia, Paramo de Ruiz, *E. Mayor 69*. Isotype (or type) in Herb. Univ. Calif.; and in U. S. Nat. Herb.

6. *CTENOPTERIS ATROVIRIDIS* Copeland, sp. nov.

C. rhizomate breve, valido, paleis ferrugineis late lanceolatis brevi-ciliatis sparso; stipitibus fasciculatis, 10 cm longis, gracilibus, brunneis, pilosis pilis rufis 2 mm longis; lamina 10–15 cm (vel ultra) longa, 8 cm lata, basi truncata, pinnatisecta, rhachi plumbea inferne pilosa; segmentis usque ad 5 cm longis, 5 mm latis, apud rhachin dilatatis, integris, herbaceis, atroviridibus; venis sterilibus simplicibus; soris inframedialibus ad latera acroscopica venarum, sporangiis nudis.

COSTA RICA: Turrialba volcano, alt. 3,000 m, *Rubén Torres Rojas 195*. Type, in U. S. Nat. Herb., has five fronds, all without the apex.

Among species with truncate base, this one is remarkable for texture and color.

7. *CTENOPTERIS LONGISETULOSA* Copeland sp. nov.

Plate 14.

C. rhizomate breve, crasso, paleis atrocastaneis linearibus 4 mm longis ciliatis dense vestito; stipitibus fasciculatis 15 cm longis 0.6–1.0 mm crassis, nigris, rhachibusque pilis sparsis ferrugineis 3 mm longis ornatis; lamina 15 cm longa, 4–5 cm lata, acuta, basi truncata, tantum pinnata; pinnis horizontalibus, acutis vel subobtusis, 4 mm latis, adnatis vix confluentibus, integris, subcoriaceis, parce ciliatis, superne glabris laete viridibus, inferne setis atrocastaneis persparsis ca. 0.6 mm longis ornatis; venis plerisque simplicibus, brevibus; soris ad venas terminalibus, medialibus; sporangiis setis atrocastaneis ca. 1 mm longis deciduis ornatis.

COLOMBIA, Dept. Antioquia, Rionegro; 1. *Bro. Daniel 68a*.

Distinguished from *Ctenopteris meridensis* by the long setæ on the sporangia.

8. *CTENOPTERIS KOOKENAMAE* (Jenman) Copeland, comb. nov.

Polypodium kookenamæ JENMAN *apud* BAKER, Trans. Linn. Soc. II 2 (1887) 292.

"Rhizomate valido breviter repente vel suberecto paleis subulatis castaneis ciliatis dense vestito, stipitibus castaneis elongatis parce ciliatis, frondibus oblongo-lanceolatis subcoriaceis glabris simpliciter subpinnatis,

rhachide primaria anguste alato, pinnis lanceolatis acutis integris basi confluentibus, costis immersis, venis furcatis, soris medialibus obscure immersis."

"Stipes 6-9 in. long. Lamina 6-8 in. long, 2 in. broad, truncate at the base, dark green above, pale beneath. Pinnæ 16-20 on a side below the subentire acuminate apex of the frond, the largest an inch long, $\frac{3}{4}$ - $\frac{1}{2}$ in. broad primary rhachis purpuraceous on both sides of the frond. Sori terminal on the anterior fork of each vein."

Roraima. Im Thurn No. 186.

"Mr. Jenman says it is intermediate between *P. Kalbreyeri* and the Jamaican *P. brunneo-viride*."—Baker, l. c.

Represented in the U. S. Nat. Herb. by Cuatrecasas 18855, from Colombia, Dept. del Cauca, sources of the Rio Palo, alt. 3,300 to 3,350 m.

Remarkable for its long, slender stipes, usually longer than the lamina. The fronds are pinnate near the base, and a few lowest pinnæ are reduced. Sporangia naked; annulus 12 to 15 cells; spores tetrahedral. The marginal setulæ on the paleæ originate as in *Ctenopteris pendula*.

9. CTENOPTERIS NUDICARPA Copeland, sp. nov.

Plate 15.

C. rhizomate valido, paleis parvis castaneis ciliatis vestito; stipitibus confertis, 10-20 cm longis, 1.2 mm crassis, nigrescentibus, basi pilis nigro-rubidis 2 mm longis alibi pilis minutis deciduis sparsis vestitis; lamina stipiti æquilonga, basi truncata, pinnata, rhachi inferne velutina; pinnis usque ad 4 cm longis, 3 mm latis, modo remotis, basi inconspicue dilatatis vix confluentibus, sparse minute ciliatis aliter glabris, coriaceis, pallide viridibus; venis fertilibus furcatis ramis ambobus elongatis; soris supramedialibus, sporangiis nudis, sporis globoso-triletis.

BOLIVIA: Hacienda Simaco sobre el camino a Tipuani, alt. 1,400 m; O. Buchtien 5253. Type in U. S. Nat. Herb.

POLYPODIUM TENUIFOLIUM Humboldt & Bonpland.

Polypodium tenuifolium HUMBOLDT & BONPLAND *apud* WILLDENOW, Sp. Pl. V (1810) 185; METTENIUS, Pol. 51; HOOKER, Sp. Fil. IV 192.

Polypodium camptoneuron FÉE, Genera (1852-3) 237, VII Mem. 60, Plate 23, fig. 1, typified by Linden 1886, from Cuba.

"P. frondibus pinnatis, pinnis linearibus acutiusculis subrepandis sessilibus adnatis, soris solitariis. W."

"*Polypodium tenuifolium*. Humboldt et Bonpland."

"F. tenuius et undosum. Plum. fil. 66, t. 85."

"Dünablättriger Engelsüss. W."

"Habitat in Cumanacoe et Hispaniolae arboribus (v. s.)."

"Frondes semipedales et fere pedales pinnatae glabrae, pinnis pollicaribus vel sesquipollicaribus linearibus angustissimis acutiusculis integerimis subrapandis alternis sessilibus adnatis. Sori parvi solitarii. A P. Otite praeter alios characteres jam fronde pinnata abunde diversum. W."—Willd., l. c.

We have a single specimen referable to this species, *H. H. Smith 1025*, from Santa Marta, Colombia, which is an excellent match for Fée's figure of *Polypodium camptoneuron*. Its fronds are glabrous.

This is an isolated species, and I am not sure that it is a *Ctenopteris*. The elongate rhizome suggests *Polypodium*, but the stipe does not seem to be articulate. I find no spores on our specimen; Fée described them as "ovoideis rotundisque." His figure shows them as elongate. The veins are described as simple. The stipe is 3 cm long. About 3 pairs of basal segments are shortened.

Polypodium pulchrum Mart. et. Gal., Mém. Acad. Brux. 15 (1842) Plate 8, fig. 2, described from Jalapa, Mexico, must be similar to *P. tenuifolium*.

10. *CTENOPTERIS FENDLERI* Copeland, nom. nov.

"*Polypodium radicale* MORITZ": HIERONYMUS, Bot. Jahrb. 34 (1904) 511, non Hooker & Baker (1867).

Rhizome stout, short-creeping, paleæ atrocastaneous, dark-ciliate; stipes 8 to 12 cm long, densely pilose; lamina 15 to 20 cm long, 20 to 25 mm wide, base truncate but not dilated, pinnate near base, elsewhere pinnatisect, rachis blackish; segments 4 mm wide, obtuse, contiguous, ciliate, surfaces sparsely setose, herbaceous; veins forked; sori medial.

VENEZUELA, *prope Coloniam Tovar*, Fendler 215.

The description by Hieronymus is very detailed.

Isotype in U. S. Nat. Herb.

"*Polypodium radicale* Moritz" of Hooker and Baker is *Ctenopteris meridensis*. *Polypodium Fendleri* Eaton is a *Campylo-neuron*.

11. *CTENOPTERIS SUBIMPRESSA* Copeland, sp. nov.

C. rhizomate parvo, adscendente, paleis 1 mm longis parietibus anticlinis castaneis aliter hyalinis setis multis albidis ciliatis vestito; stipitibus confertis, 4 cm longis, gracilibus, minute furfuraceis glabrescentibus; lamina 10–12 cm alta, 4 cm lata, basi truncata, pinnata, rhachi costisque nigris; pinnis 2.5 cm longis, 2 mm latis, basi decurrentibus non confluentibus,

papyraceis, glabris venis fertilibus pseudo-simplicibus; soris medialibus, ad latera acroscopica venarum insertis, leviter impressis, sporangiis nudis.

PERU: "Dept. Junin, East of Quimiri Bridge, near La Merced; alt. 800 to 1,300 meters, dense forest. Epiphyte." Killip & Smith 23842.

The fine pinnæ suggest *Polypodium filicula*, to which it is not nearly related. There is some probably affinity to *Ctenopteris nudicarpa*, which is much less delicate and with different paleæ.

12. *CTENOPTERIS MERIDENSIS* (Klotzsch) Copeland, comb. nov.

Polypodium meridense KLOTZSCH, *Linnaea* 20 (1847) 380.

Polypodium spixianum MARTENS *apud* METTENIUS, *Polyp.* (1857) 57.

"*Polypodium radicale* Moritz" in HOOKER & BAKER, *Syn. Fil.* (1867) 332, *non* HIERONYMUS, *Bot. Jahrb.* 34 (1904) 511.

Polypodium brunneo-viride BAKER *apud* JENMAN, *Jour. Bot.* 15 (1877) 265.

Rhizome short and stout, paleæ copious, atrocastaneous, linear, attenuate, ciliate; stipes fascicled, elongate, sometimes longer than the lamina, black, bearing long hairs but glabrescent; lamina attenuate to apex, truncate at base, pinnatisect, rachis pubescent above, deciduously so beneath; segments confluent at base, acute or acuminate, coriaceous, ciliate, surface more or less setose beneath, usually glabrescent; veins forked and both branches developed; sori medial, sporangia naked.

Collections in hand: COLOMBIA, *Lehmann XLV*, *Stuebel* 186, *Arbelaez* 1513, *Killip* 34085, *Killip & Smith* 15910, 15973, 20627, 20666, 21149, *Killip, Garcia & Gutierrez V* 38061, *Cuatrecasas* 17948, *Daniel* 558, 2648; VENEZUELA, *Gehriger* 584A, *Steyrmark* 62589; PERU, *Bues* 2183, *Macbride* 3491, 5145, *Killip & Smith* 29539. COSTA RICA, *Valerio* 68, *Standley* 38838; JAMAICA, *Sherring s. n.*, *Hart* 39, *Maxon* 2637, 2705, 10192, 10586, *Maxon & Killip* 1160, 1710, *Orcutt s. n.* HAITI, *Ekman* 7714, 11722, 12820.

Polypodium spixianum and *Polypodium radicale* Moritz of Hooker and Baker are reduced to *Polypodium meridense* by Baker, *Flora Bras. I Pars* 2, p. 514. *Polypodium radicale* survives in the index but not in the text of the Second Edition of *Synopsis Filicum*. They are represented by *Wacket* 210 and *Brade* 844, from S. Paulo.

Polypodium brunneo-viride is reduced because I do not see wherein it differs from *Ctenopteris meridensis*.

POLYPODIUM CARNOSULUM Christ.

Polypodium carnosulum CHRIST, Bull. Boiss. II 4 (1904) 1102.

"Stipite 5 cm longo rigido valido, castaneo, fronde 10 cm. longa 4 cm lata oblonga basi vix attenuata, simpliciter pinnata pinnis 2 cm. longis, 2½ mm. latis pectinato-imbricatis (nullo sinu interposito) linearibus margine integris obtusis sive acutiusculis numerosis (circa 30 utroque latere) dure coriaceis crassis atro-viridibus subtus pallidioribus glaberrimis uti tota planta except capite rhizomatis coma brevi castanea squamarum filiformium praedito, nervis nigris obliquis furcatis, soris magnis luteis mediis circa 8 utroque costae latere."—Christ, l. c.

Werkle, 1903.

13. CTENOPTERIS KALBREYERI (Baker) Copeland, comb. nov.

Polypodium Kalbreyeri BAKER, Trans. Linn. Soc. II 2 (1887) 291.

Polypodium longipes FÉE, Crypt. Vasc. Bras. II (1872-3) 53, *Plate 95*, fig. 3, non Link.

Polypodium pressum BRAUSE, Fedde's Repert. 18 (1914) 294.

Polypodium transiens LINDM., Ark. vör Bot. 1 (1903) 235, *Plate 2*, fig. 2.

"Eupolypodium . . . rhizomate breviter repente paleis parvis patulis linearibus brunneis vestito, stipitibus contiguis elongatis erectis atrobunneis, frondibus deltoideis simpliciter pinnatis coriaceis glabris, rachide nuda castanea, pinnis linearibus adnatis contiguis integris superioribus sensim minoribus, venis immersis occultis furcatis, soris globosis superficialibus latitudinem totam pinnarum inter costam et marginem occupantibus."

"Stipes 8-10 in. long, naked or furnished towards the base with minute, squarrose, soft, hair-like paleæ. Rachis castaneous, like the stipe. Lamina 5-6 in. long 3-3½ in. broad at the base. Pinnæ about 20 on a side below the caudate apex of the frond, ½ in. broad at the base, narrowed gradually to an acute point."

"Nearest the Adine *Polypodium melanopus* Hook. et Grev., from which it differs by its stiffly erect stipes, frond broadest at the base, with obscure immersed veins."

The stout rhizome is usually more nearly erect than creeping; and the "hair-like paleæ" are hairs.

A well defined species, recognizable by commonly triangular glabrous fronds, and ferruginous to brown paleæ, sparsely or not at all ciliate.

Polypodium longipes Fée was described from the Organ Mountains near Rio, *Glaziou 4414*. *Polypodium transiens* was published as a new name, not a new species, the only specimen cited being *Mosen 3535*, from near Santos. The originally cited specimen of *Polypodium Kalbreyeri* was from Roraima, but the name is from an earlier collection by Kalbreyer, from Prov. Ocana, Colombia, alt. 6,500 feet.

Specimens in hand are: from Guatemala, *Cook & Griggs 441*; from Costa Rica, 13 collections; from Panama, *Maxon 5440*, a luxuriant specimen; from Colombia, *Killip 11570*, the lamina 5 cm long by 4 cm wide; from Venezuela, *Steyermark 59815*, and *Tate 578*, from Duida, with one found 12 cm long by 14 cm wide; from Peru, *Schunke A154*; from Minas Geraes, *Mulford & Racine Foster 698*, with the form of *Ctenopteris meridensis* but the paleæ of *Ctenopteris Kalbreyeri*.

GROUP OF CTENOPTERIS CURVATA

(Frond ceraceous, not hairy)

Key to the species

Fronds pinnatifid.

Segments fully confluent.

Fronds over 10 cm long.

Paleæ entire or nearly so.

Wing less than 1 mm wide 2. *C. Herrezæ*

Wing of rachis 1 to 2 mm wide.

Sori somewhat impressed 1. *C. curvata*

Sori superficial.

Sori submarginal 3. *C. albidula*

Sori medial 4. *C. subcrassa*

Less deeply lobed or pinnatifid 5. *C. discolor*

Paleæ ciliate 6. *C. amylacea*

Fronds 2 to 3 cm long 7. *C. pruinosa*

Segments semiadnate 8. *C. farinosa*

Fronds pinnate 9. *C. fragillima*

1. CTENOPTERIS CURVATA (Swartz) Copeland, comb. nov.

Polypodium curvatum SWARTZ, Schrad. Jour. 1800 (1801) 24. Syn.

Fil. 34; C. CHR., Ark. för Bot. 9^s (1910) Plate 3.

Polypodium curvans METTENIUS, Ann. Sc. Nat. V 2 (1864) 253.

Polypodium inaequale FÉE, Mem. XI (1866) 47, Plate 12, fig. 3, nec aliorum.

"*P. curvatum*, frondibus pinnatifidis, laciniis lineari-lanceolatis subfalcatis adscendentibus remotis, fronde subsessili."

"Flor. Ind. occ. p. 1639."

"Jamaica."—Swartz, Synopsis.

Rhizome short, paleæ ferruginous to castaneous, 3 mm long, lanceolate, entire; stipes densely fascicled, 0 to 1 cm long, stout; lamina 30 to 45 cm long, 6 cm wide, variously curved near the base, apex short-caudate becoming entire elsewhere pinnatifid to a wing 1 to 2 mm wide, rachis naked, immersed; segments 3 to 5 mm wide, patent, narrowed from dilated base to acute or obtuse apex, mostly entire, fleshy, glabrous, beset with

pale granules which darken and fall off; veins immersed, forked, fine; sori extra-medial, slightly impressed, round, sporangia naked, pedicle one row of cells, paraphysate, spores mostly tetrahedral.

CUBA, *Ekman* 7087, *Morton & Acuña* 3656, 3789. HISPANIOLA, *Ekman* H 2980, H 3890, H 19734. JAMAICA, *Hart* 14, *Sherring*, *Harris* 7321, *Clute* 117, *Maxon* 1074, 1264, 1308, 1522, 2628, *Maxon & Killip* 671, 744, *Watt* 146. GUADELOUPE, *l'Herminiere*, *Duss* 4073. DOMINICA, *Eggers* 899. COLOMBIA, *Killip* 11362, *Daniel* 13, 573.

The Colombia specimens are aberrant, having broader and shorter segments, and thus approaching *Ctenopteris discolor*.

Hooker, Sp. Fil. IV 201, described as *Polypodium curvatum* a distinct Andean plant, perhaps a mixture, justifying his speculation. "Possibly Swartz's plant may be different from ours."

2. CTENOPTERIS HERRERÆ Copeland, sp. nov.

C. rhizomate parvo, erecto; stipitibus fasciculatis, 0-1 cm altis, fuscis; lamina 15 cm alta, 2 cm lata, utrinque abrupte contracta, pilis ubique carentibus, utraque facie rhachique amy-laceis, pinnatifida; segmentis obtusis, erecto-patentibus, 2.5 mm latis, integris, anguste confluentibus, subcoriaceis; venis omnino inconspicuis, furcatis; soris medialibus, magnis, superficialibus, sporangiis nudis.

PERU, 9,000 feet alt., *Bues* 1268 (sterile), 1269 (without rhizome). Presented to the U. S. Nat. Herbarium by Prof. F. L. Herrera.

I cannot be sure of paleæ on No. 1268.

Bues 1809 is remarkably similar in gross appearance to *Ctenopteris Herreræ*, but has setose, pinnate lamina, and simple veins.

3. CTENOPTERIS ALBIDULA (Baker) Copeland, comb. nov.

Polypodium albidulum BAKER, Fl. Bras. I² (1870) 598; Syn. Fil. (1874) 509.

Polypodium Pearcei BAKER, Syn. Fil. 1874) 508.

Polypodium subinaequale CHRIST, Ark. för Bot. 9¹⁵ (1910) 2.

"Mihi *P. curvatum* forma," C. CHR., Index Suppl. III 159.

"Caud. short, erect; basal scales linear-subulate, bright-brown; st. slender, firm, gray, naked, 1½-2 in.; fr. pendulous, lanceolate, 4-8 in. l., 6-12 lin. br., cut down to rachis into adnate ligulate subacute pinnæ 1-1½ lin. br., the lower lax and gradually reduced; texture subcoriaceous; lower side densely white-pruinose; veins immersed, 10-12-jugate, rarely forked, not reaching the edge; sori round, superficial, submarginal."

"Hab. Rio Janeiro, *Glaziov 3579*."—Baker, Syn. Fil.

"A *P. pendulo* Sw. differt statura majore textura valde coriacea, soris marginalibus non immersis."

(Brazil; Parana) "Serra do Mar, Monte Alegre (Morro da Farinha Secca), an Baumstämmen in einer Höhe von etwa 900 m. (Dusen No. 3446)."—Christ, l. c. Isotype in U. S. Nat. Herb. S. Paulo, *Leite 3547*, *3665 Wacket, Ros. 288; Sta. Catharina, Spannagel 201*.

"Fronds 15–40 cm long. Rhizome . . . conspicuously paleaceous, the scales yellowish brown . . . subentire, bearing an occasional minute unicellular gland-like process; stipes 1 to 3 cm. long . . . bearing a few very slender yellowish hairs about 2 mm. long, these readily deciduous; lamina oblanceolate (in small plants) to linear . . . subpinnatisect throughout, gradually attenuate toward the base; pinnules . . . the lowermost ones . . . short-decurrent, almost vestigial; pinnules in general narrowly triangular-oblong . . . connected by a costal wing less than 1 mm. broad . . . veins 8 to 12 pairs, very oblique, wholly immersed, mostly once forked at or beyond their middle; sori 7 to 10 pairs, superficial, terminal upon the short distal branches, much nearer to the margin than to the midrib . . . sporangia glabrous, the annulus with 14 cells; spores triplanate . . . Leaf tissue very rigidly spongiouse-herbaceous, freely but minutely viscid-glandular beneath, sparingly so above."—Maxon, l. c.

This has been confused with *Ctenopteris pendula*, but the real resemblance and affinity are to *Ctenopteris curvata*, as noted by Christensen.

The specimens here referred to one species are too few to permit positive judgment as to their identity or difference. The isotype of *Polypodium subinæquale* has the broadest segments, least oblique at base. But all are so similar that, on the evidence in hand, I do not feel justified in maintaining them as distinct species.

4. CTENOPTERIS SUBCRASSA Copeland, sp. nov.

Polypodium Luederswaltii Ros.?

Rhizomate erect, paleis anguste lanceolatis integris acuminatis castaneis dense vestito; stipitibus 3–5 cm longis brunneo-hirsutis; lamina 25 cm longa, basi vix contracta, apice abrupte contracta, ad alam 2 mm latam pinnatifida, segmentis erectopatentibus, ciliatis, sparsissime setosis, textura subcrassa non coriacea; venis furcatis; soris medialibus, sporangiis nudis, sporis globoso-tetrahedralibus.

BRAZIL, San Paulo; Campo Grande, alt. 800 meters. L. A. C. Brade. Epiphytic.

Near *Ctenopteris albidula*, but different in several respects,—stipe hairy, sori medial.

5. CTENOPTERIS DISCOLOR J. Smith.

Ctenopteris discolor (Hooker) J. SMITH, Hist. Fil. (1875) 185.

Polypodium discolor HOOKER, Ic. Plant. (1841) Plate 386.

"Caespitosum, fronde lanceolata subcoriacea pinnatifida, supra viridi glabra subtus pulvereo-albida laciniis oblongis obtusis integerrimis, soris marginalibus uniserialibus."

"Hab. British Guiana; *Mr. Schomburgh* n. 1031."

"This is very different from any *Polypodium* with which I am acquainted, and remarkable for the underside being covered with a white purverulent substance, which contrasts curiously with the dark and naked upper surface. The costa or midrib is slightly prominent on both sides; but the venation is altogether internal, and is quite obsolete on the surface. Sori dark brown, orbicular."—Hooker, l. c.

Rhizome ascending, densely covered by brown, attenuate, entire paleæ up to 7 mm long by 1 mm wide; stipes stout, 0 to 1 cm long, furfuraceous, glabrescent; lamina coriaceous, lobed $\frac{1}{2}$ to $\frac{3}{4}$ of the way to the "rachis"; lobes rounded or subacute, entire; pedicel one row of cells, annulus 13 or 14 cells, sometimes slightly oblique, spores globose-tetrahedral.

BOLIVIA, *Williams* 2592, *Buchtien* 5246; PERU, *Schunke* A 152, 513; COLOMBIA, *Killip & Hazen* 9461.

An isolated species, as remarkable for the large paleæ, and limited dissection of the lamina, as for the ceriaceous covering of the nether surface.

6. CTENOPTERIS AMYLACEA Copeland, sp. nov.

Plate 16.

C. C. curvatæ persimilis, paleis atrocastaneis ciliatis distincta.

BOLIVIA: Cargadira, alt. 8,000 ft. *L. Williams* 1134, July 29, 1905. Two sheets in U. S. Nat. Herb. Nos. 700281, type, and 1832071.

Lamina 35 cm long, 4 to 6 cm wide, decurrent to the rhizome, stipe thus short or none, very stout; rachis immersed, glabrous, its wing 2 mm wide; segments 5 mm wide, moderately dilated-decurrent at base, obtuse, entire, coriaceous, surfaces beset with whitish granules; veins forked, the branches about equally long; sori submarginal, superficial, sporangia naked, annulus about 13 cells, spores tetrahedral.

Segments wider than on typical *Ctenopteris curvata*, not as wide as on the Colombian specimens tentatively ascribed to that species. Hooker, Sp. Fil. IV 201, referred several Andean collections to *Ctenopteris curvata*; this must have been an error, but I may not guess what they really are. We have nothing in the group from Ecuador.

7. CTENOPTERIS PRUINOSA (Maxon) Copeland, comb. nov.

Polypodium pruinosa MAXON, Proc. Biol. Soc. Wash. 52 (1939) 117.

Polypodium pruina BAKER, Syn. Fil. (1874) 508, non Swartz.

"Basal scales linear, minute ferruginous; fr. sessile, densely tufted, erect, oblanceolate, 6-10 lines l., 3 lin. br., blunt, deltoid at base, cut more than halfway down to the rachis into 5-6-jugate blunt lobes under 1 lin. br.; texture subcoriaceous; surfaces clothed with fine short brown hairs, and the lower slightly pruinose; veins pinnate in lobes, with 2-3-jugate veinlets not reaching the edge; sori round, 4 to central lobes, medial."

"Hab. Chontales, Nicaragua, Ralph Tate, 44."

Apparently known only by the original collection. A dwarf, but not recognized as a dwarf form of any species of normal size. As observed by Maxon, the granules are scattered over both surfaces.

8 CTENOPTERIS FARINOSA (Hooker) Copeland, comb. nov.

Polypodium farinosum HOOKER, Icones Pl., X (1854) Plate 947;

SODIRO, Crypt. Vasc. Quit. (1893) 328.

"Parvum submembranaceum fronde elliptico-lanceolata pinnata utrinque pulveraceo-farinosa albida, pinnis approximatis lineari-oblongis patentibus sessilibus subdecurrentibus obtusis sinuato-crenatis basi sursum obtuse auriculatis, venis unifurcatis apice clavatis, venula superiore apice sorifera, soris medio intra costam et marginem uniseriatis magnis aureis, stipite gracili brevi nudo."

"Hab. On the trunk of an old tree at the eastern (Sodiro says Western) ascent of the Cordillera of Quito, where the forests commence; rare, and very few specimens were gathered, Prof. W. Jameson."—Hooker, l. c.

9. CTENOPTERIS FRAGILLIMA Copeland, sp. nov.

C. rhizomate breve adscendente, paleis castaneis lanceolatis integris 3 mm longis laxe vestito; stipitibus approximatis, ca. 4 cm longis, filiformibus, fuscis, decidue brevi-setosis; lamina usque ad 15 cm longa, 1 cm lata, pinnata, rhachi filiforme pilis sparsis 1-2 mm longis caducis vestita; pinnis patentibus vel erecto-patentibus plerisque 6 mm longis, 2 mm latis, obtusis, integris vel crenulatis, rigidis, perfragilibus, opacis, glabratibus, ceraceis, basi adnatis, decurrentibus non confluentibus; soris medialibus, in undumento ceraceo immersis.

VENEZUELA, Summit of Mt. Roraima, alt. 2,700 to 2,740 m, September 28, 1944, J. A. Steyermark 58882.

Like *Ctenopteris discolor* in its dense ceriaceous covering, whitish at first, darkening with age, but differing so widely in the stipitate, dark, pinnate, narrow frond that they are probably not nearly related. The fronds form dense tufts.

APPENDIX

SPECIES BELIEVED TO BE CTENOPTERIS

- Polypodium amphidasyon* KUNZE, Mett., Pol. (1856) 49. (No. 51.)
Polypodium crispulum CHRIST., Bull. Boiss. II 4 (1904) 1102.
Polypodium exsudans CHRIST., Bull. Boiss. II 4 (1904) 1103.
Polypodium microphyllum Mettenius.
Polypodium Moritzianum LINK., Fil. Sp. Cult. (1841) 126.
Polypodium Stübelii HIERONYMUS, Hedw. 48 (1909) 252.
Polypodium sublongipes CHRIST., Bull. Soc. Bot. Genève II 1 (1909) 218.
Polypodium subscabrum KLOTZSCH, Linnaea 20 (1847) 377.
Polypodium Waeringii C. CHR., Bot. Tids. 25 (1902) 77.
Polypodium xiphopteroidaeifolium JENMAN, Gard. Chron. III 18 (1895) 612.
Polypodium pectinatum Linnæus, large ferns; veins branching; spores biletæ. A considerable number of similar ferns.
Polypodium Plumula H. B. W. Small ferns, not numerous. Paleæ on rachis. Spores biletæ.



ILLUSTRATIONS

[All subjects are types, in United States National Herbarium.]

PLATE 1. *Ctenopteris Rosarum* Copeland.

2. *C. Pennellii* Copeland.
3. *C. Congesta* Copeland.
4. *C. nudipes* Copeland.
5. *C. Chaseæ* Copeland.
6. *C. Knightii* Copeland.
7. *C. Rhizophoræ* Copeland.
8. *C. epiphytica* Copeland.
9. *C. vernicosa* Copeland.
10. *C. major* Copeland.
11. *C. attenuatissima* Copeland.
12. *C. Longipinnata* Copeland.
13. *C. ambigens* Copeland.
14. *C. longisetulosa* Copeland.
15. *C. nudicarpa* Copeland.
16. *C. amylacea* Copeland.





PLATE 1.



PLATE 2.

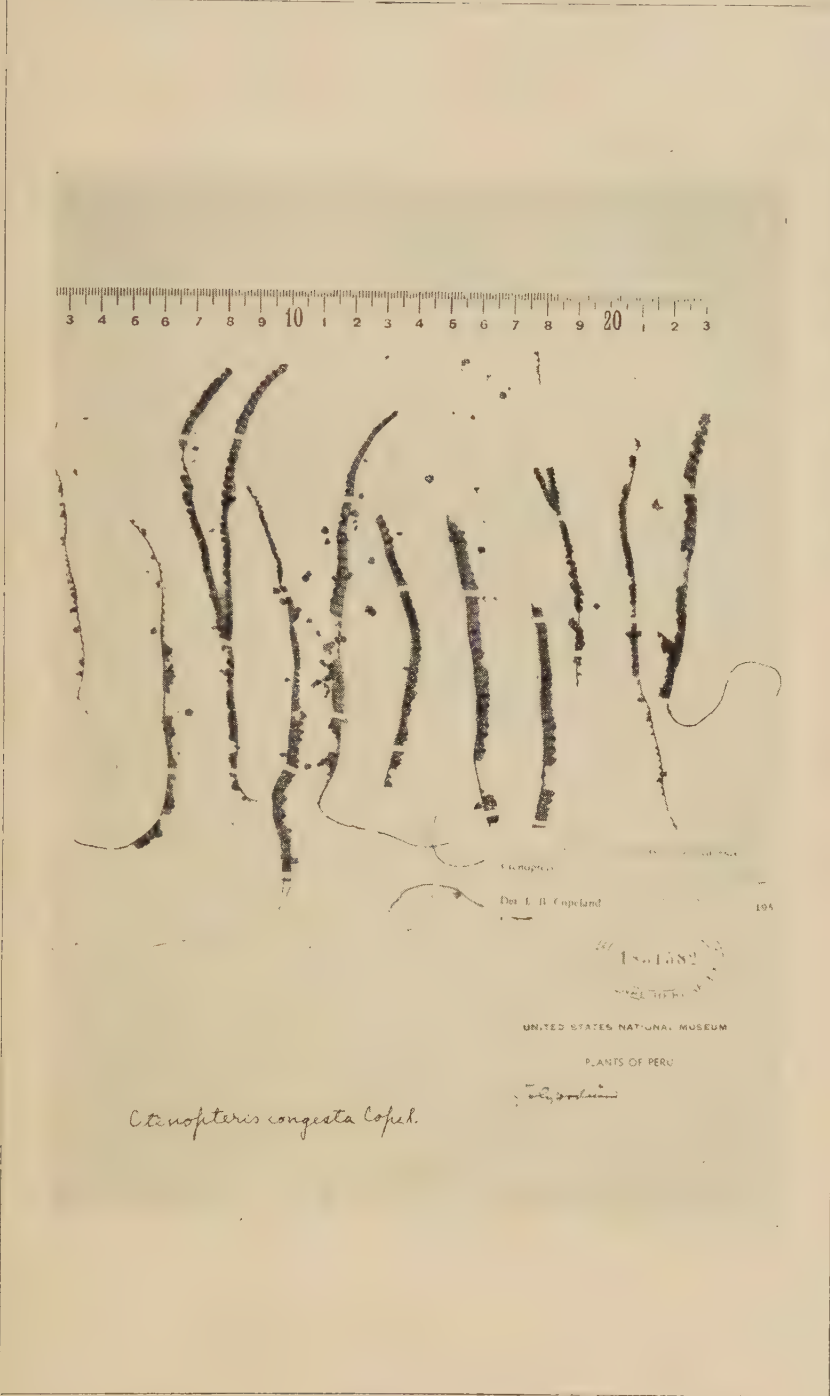


PLATE 3.



PLATE 4.

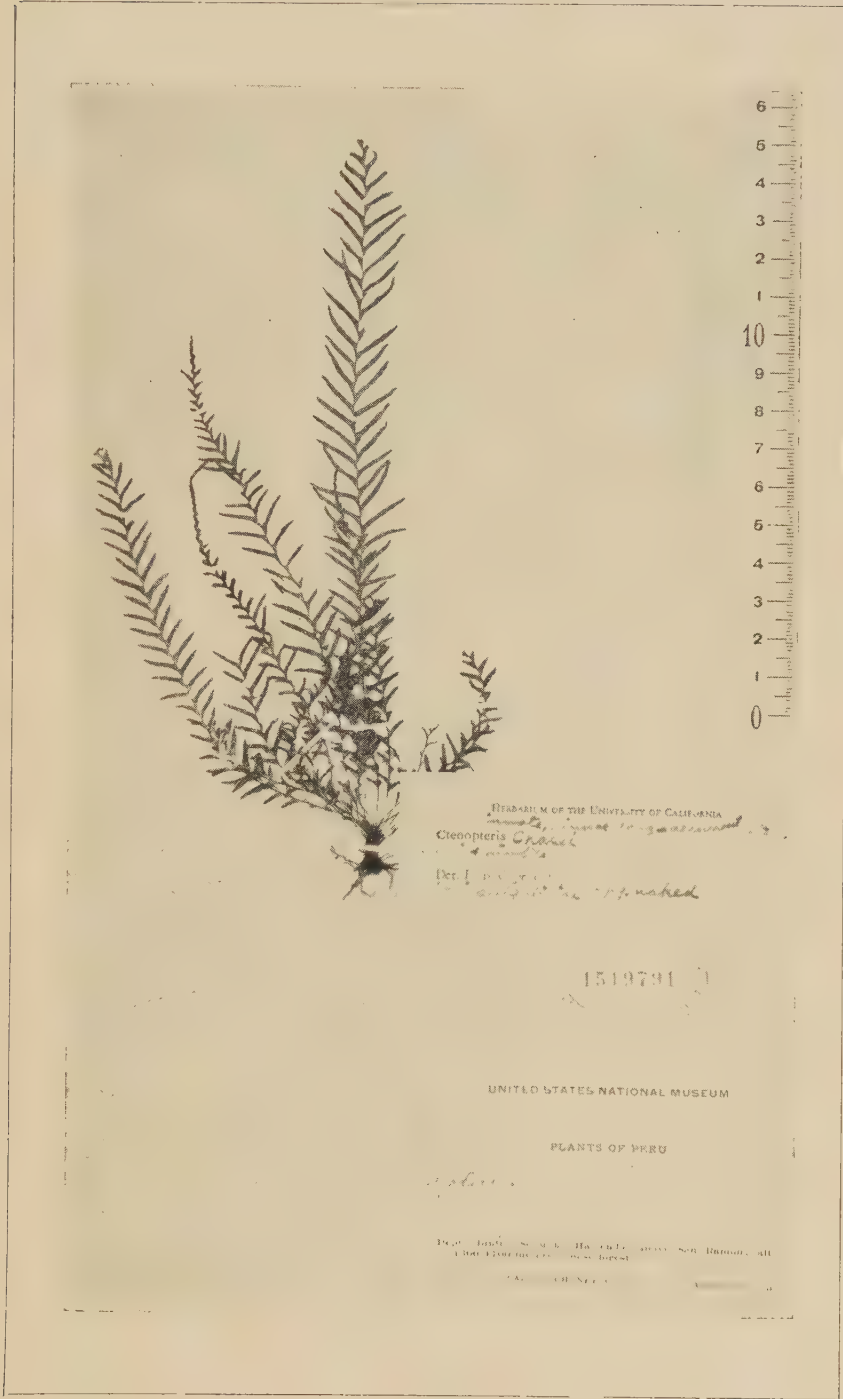


PLATE 5.



PLATE 6.



PLATE 7.



Ctenopteris epiphytica

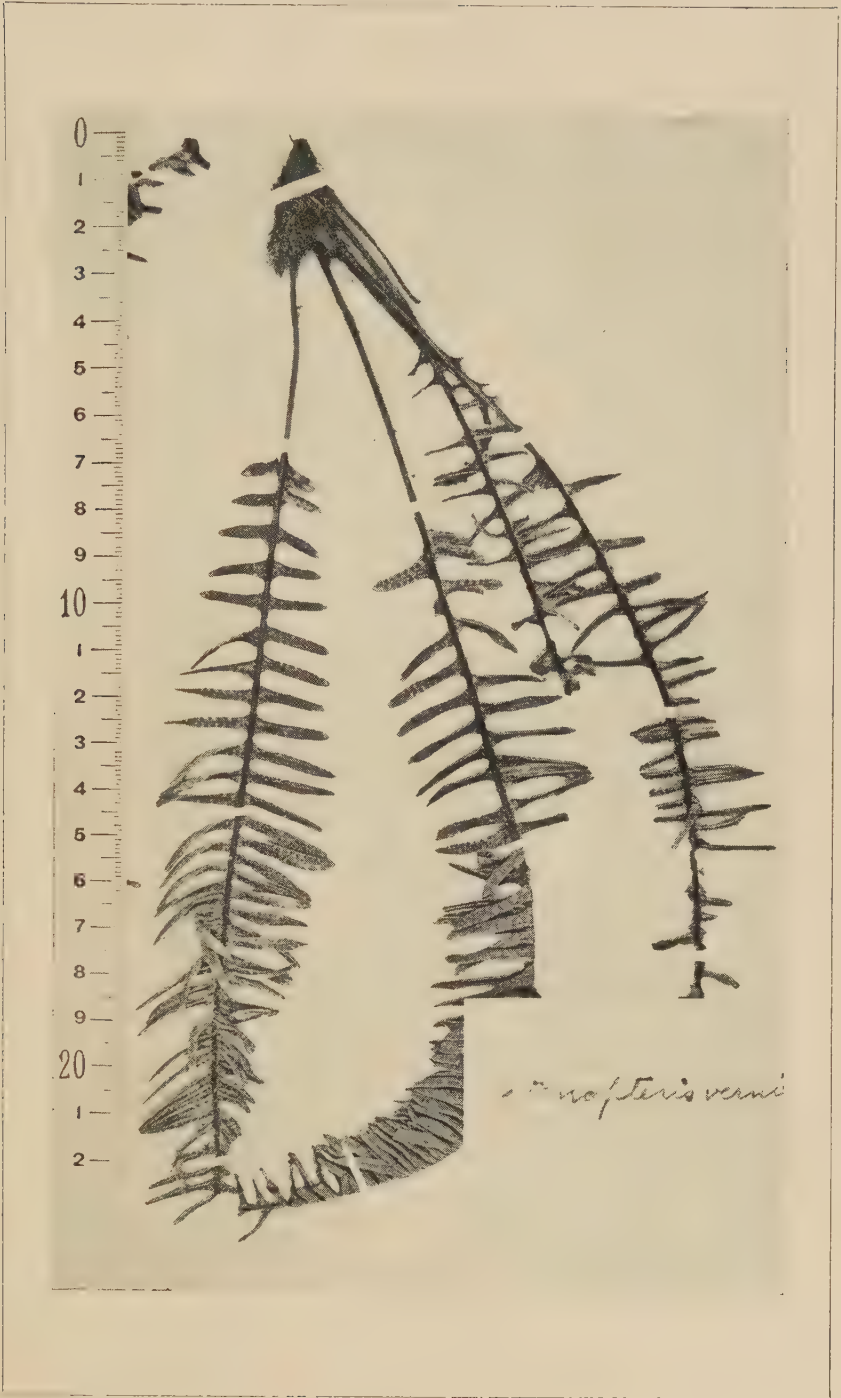


PLATE 9.

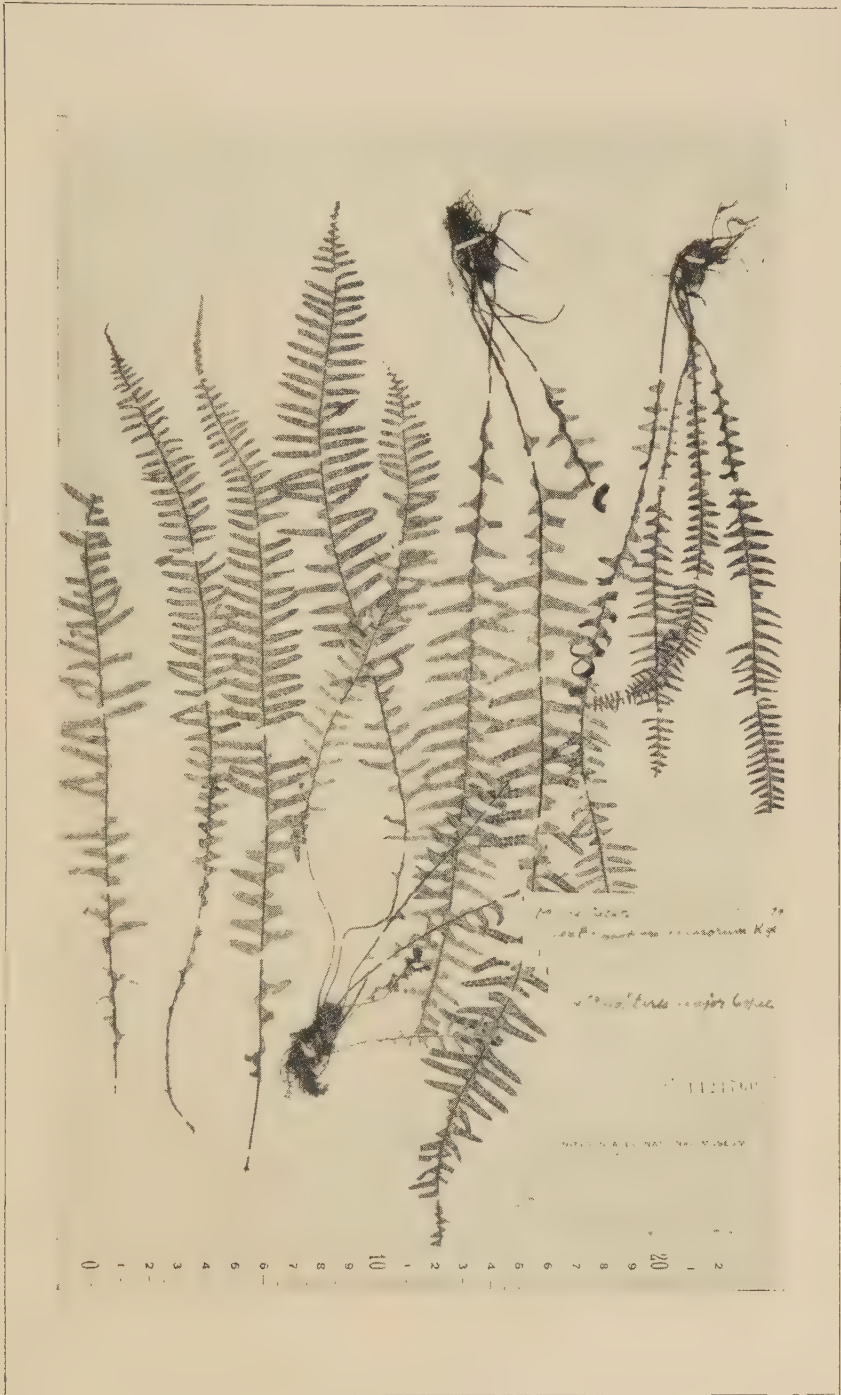


PLATE 10.

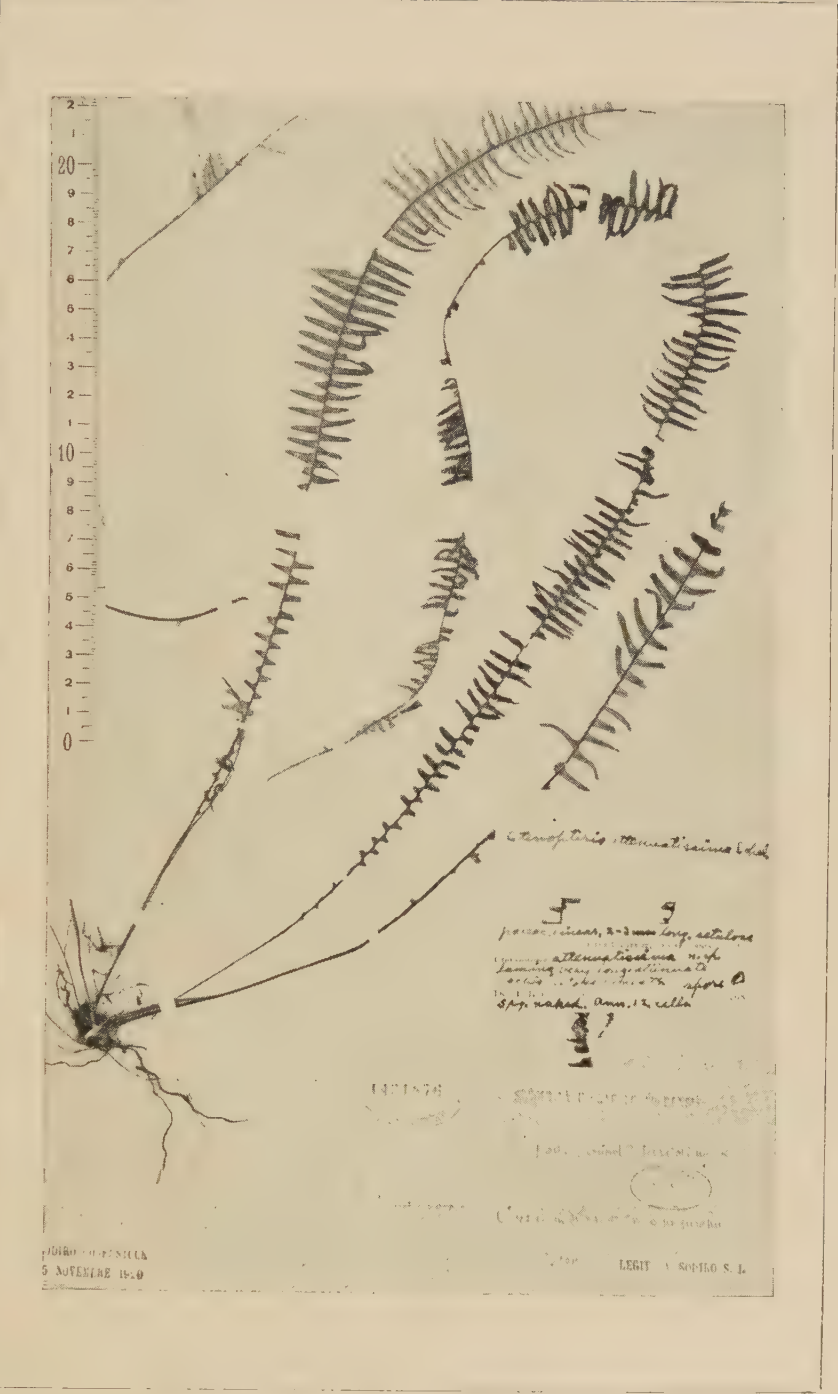


PLATE 11.



PLATE 12.



Ctenopteris *sp. nov.*
Det. E. B. Copeland 1905

1215429

UNITED STATES NATIONAL MUSEUM

PLANTS OF LORTA HILL

Ctenopteris

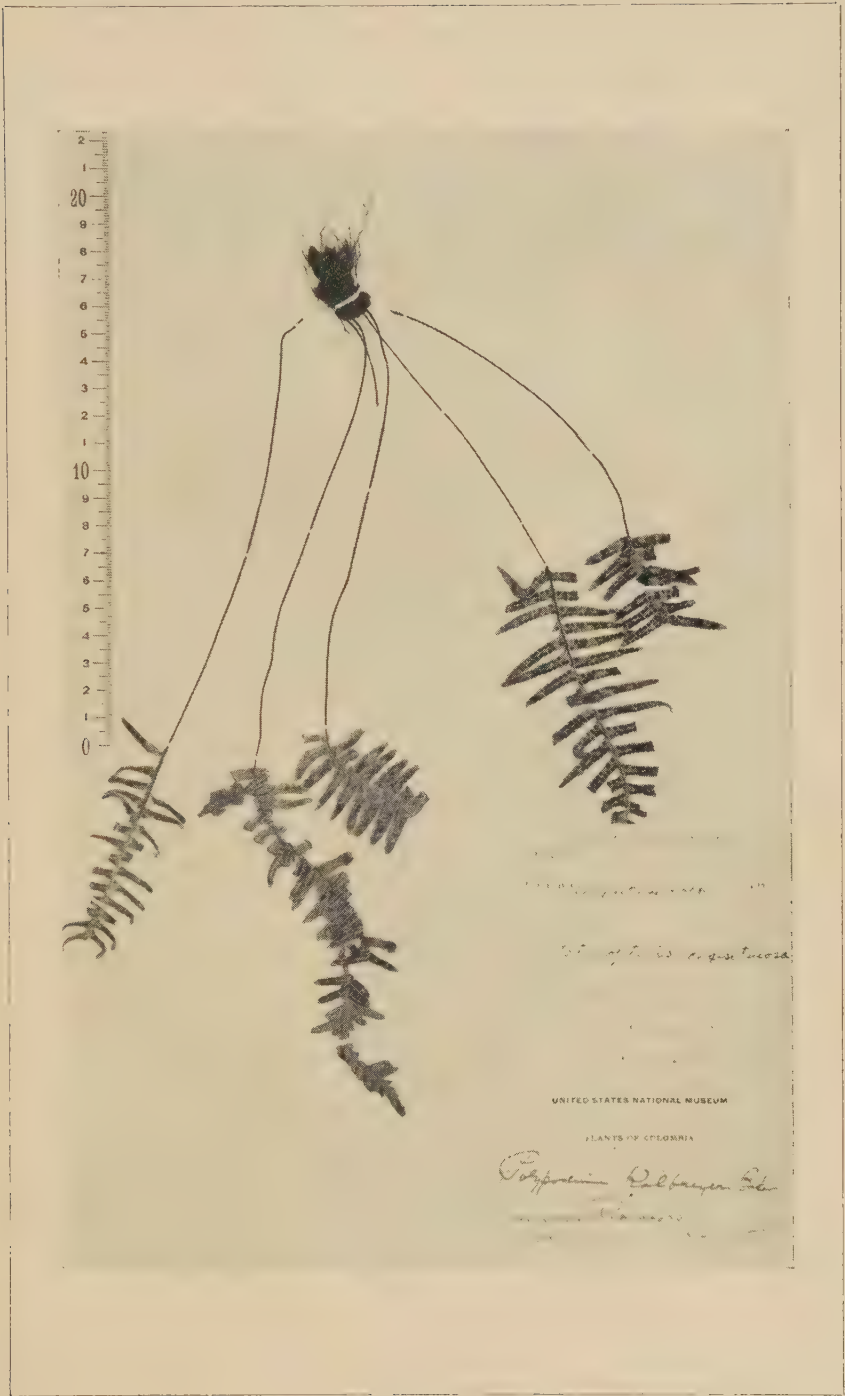


PLATE 14.



FIG. 1. B. Copeland

UNITED STATES NATIONAL MUSEUM

PLANTS OF OHIO

ERRATA

VOLUME 83

Page 332, line 7 from bottom, aboved should read above.

Page 346, line 1 from bottom, Gater should read water; and line 4 from bottom, Reef should read Beef.

Page 352, line 20, Falcultative should read Facultative.

Page 359, line 2 of title, form should read from.

Page 361, line 18 from bottom, petrolemu should read petroleum.

Page 383, line 5, shoulder=spot should read shoulder-spot.

Page 387, lines 2 and 3, *Rhinobatus* should read *Rhinobatos*.

VOLUME 84

Page 4, line 20, have should read have been.

Page 27, line 16, walkeir should read walkeri.

Page 111, line 1, Terracriini should read Teracriini.

Page 113, line 4, *Ophisthostenus* should read *Opisthostenus*.

Page 140, line 3 from bottom, *abbreviatta* should read *abbreviata*.

INDEX

[New names and new combinations are printed in *Italics*.]

A

- Abaca, 280.
 Abitsuwelas, 345; pula, 357.
 Abrus precatorius Linn., 283.
 Abutra, 282.
 Acacia, 284.
 confusa Merr., 283.
 Acalypha amantacea Roxb., 284.
 indica Linn., 284.
 Acanthaceæ, 290.
 Acanthus ebracteatus Vahl., 290.
 Acapulco, 283.
 Achras zapota Linn., 288.
 Achuete, 287, 296.
 Achyranthes aspera Linn., 282, 295, 358.
 Acle, 283.
 Aerua lanata (Linn.) Juss., 282.
 Aëta bow and arrow, collection of, 330.
 Aëtas, use of bow and arrow among the
 Visayan, 323.
 African tulip, 290.
 Agar, 284.
 Agathis philippinensis Warb., 279.
 Agave cantula Roxb., 280.
 Aglaia rimosa Lour., 284.
 Agoho, 281.
 Agoniella Ws., 230, 233, 235, 239-244.
 apicalis Baly, 250.
 banksi Ws., 241, 242, 244-247, 249.
 biformis Uh., 244, 245, 249.
 crassipes Baly, 239.
 horsfieldi Baly, 241.
 longula Gest., 242, 245, 246, 249.
 manilensis Ws., 240-242, 245, 247, 249.
 podagrica Gest., 239.
 pygmaea Gest., 242, 244, 246, 250.
 rotundicollis Gest., 242, 246, 250.
 Schultzei Uh., 246, 249.
 strandii Uh., 241, 244, 247.
 vandepollii Gest., 241, 248, 249.
 Agonita Str., 230, 233-236, 239-241.
 atripennis Pic, 235.
 bicolor, 240.
 cherapunjiensis Mlk., 234.
 Chlorina Mlk., 239.
 clavareauii Gest., 233.
 decorata Gest., 234.
 femorata Ws., 239.
 indenticulata Pic, 234.
 malangensis Ws., 233.
 mira Gest., 239.
 nigripennis, 235.
 nitida Gest., 235.
 nitidicollis Gest., 233.
 opacula, 235.
 pallipes Spaeth., 233, 239.
 saundersii Baly, 234.
 spaethi Uh., 236.
 spathoglottis Uh., 234.
 suturellamima Mlk., 234.
 tayabasensis Uh., 234.
 tricolor Chûjô, 239.
 undata Uh., 234, 239.
 (Micrispa) indenticulata Pic, 236.
 Agoyoi, 285.
 Alagaw, 289, 292.
 Alagaw-bagin, 289.
 Alas cuatro, 282.
 Alasiis, 281.
 Albizzia acle (Blco.) Merr., 283.
 ALEJO, LEON G., *see* INTENGAN, ALEJO,
 CORPUS, SALUD, DEL ROSARIO, GOMEZ,
 HENSON, and CONCEPCION. *See also*
 INTENGAN, CONCEPCION, ALEJO, COR-
 PUS, SALUD, DEL ROSARIO, GOMEZ, and
 HENSON.
 Aleurites moluccana (Linn.) Willd., 284.
 Alibangbang, 283, 346, 358.
 Alim, 285.
 Allamanda cathartica, 288.
 Allium ascalonicum Linn., 280.
 sativum Linn., 280, 294, 295.
 Almaciga, 279.
 Alocasia indica (Roxb.) Schott., 279.
 Alpasotis, 282.
 Alstonia macrophylla Wall., 288.
 scholaris (Linn.) Br., 288.
 Alternanthera versicolor Hort., 282, 294, 359.
 Alupihan, 282.
 Alysicarpus vaginalis (Linn.) DC., 283.
 Amaranthaceæ, 282, 293, 295.
 Amaranthus spinosus Linn., 282.
 Amaryllidaceæ, 280, 292.
 Amaryllis belladonna Linn., 280.
 Amoñgyong, 283.
 Amorphophallus campanulatus (Roxb.) Blm.,
 279, 294.
 Anabiong, 281.
 Anacardiaceæ, 285, 293.
 Anacardium occidentale Linn., 359, 360.
 Anacolosa luzoniensis Merr., 358.
 Anahaw, 324.
 Anang, 288.
 Andadasi, 283, 295.
 Andropogon citratus Dc., 279.
 furcatus, 143.
 Anibong, 326.
 Anilan, 286.
 Anisoderini, 233.
 Anona squamosa Linn., 282.
 Anonaceæ, 282, 293.

Anoplophallus, 200.
 maculatus Cope, 200, 201.
 Antidesma buniis (Linn.) Spr., 285, 360.
 ghaeseimbilla Gaerhn., 285.
 Antipolo, 281.
 Anubing, 281.
 Aphananthe philippinensis Planch., 281.
 Api-api, 289.
 Apium graveolens Linn., 288.
 Apocynaceæ, 288, 293.
 Apug-apugan, 282.
 Araceæ, 279, 292, 294.
 Araliaceæ, 288, 293.
 Araru, 280.
 Arcangelista flava (Linn.) Merr., 282.
 ARCAÝNA, G. D., *see* DE RODA, SABILLO,
 and ARCAÝNA.
 Areca catechu Linn., 279.
 Aristolochia tagala Cham., 281.
 Aristolochiaceæ, 281, 293.
 Arthropteris heteromorpha J. Sm., 412.
 Artocarpus altilis (Park.) Fosb., 281, 295.
 blancoi (Elm.) Merr., 281.
 camansi Blo., 281.
 cumingiana, 281.
 odoratissima Blo., 358, 361.
 Asistasya, 290, 346, 358.
 Asparagus officinalis Linn., 280, 295.
 Aspidispa Baly, 230, 231, 233, 235.
 meijerei Ws., 231.
 Asystasia gangetica (Linn.) Anders., 290,
 358.
 Athyrium esculentum (Retz.) Copel., 279.
 Atis, 282.
 Atractophora Stål, 20, 21.
 Atractophora Sign., 21.
 bipunctata Fal., 31.
 fusifemur Stål, 21.
 longicornis Stål, 53.
 quadripunctata Sign., 62.
 Avertrhoa bilimbi Linn., 284.
 carambola Linn., 284.
 Avicennia merina Vierh. var. inter., 289.
 Avocado, 282.
 Ayangili, 283.
 Ayo, 286.

B

Babara, 286.
 Baboy nga talunon, 324.
 Bacillus subtilis (Cohn) Prazn., 276.
 Bagakay, 324, 326.
 Bagna, 285.
 Bago, 279, 294.
 Bagos, 284.
 Bains, 345, 357.
 Bakatin, 324.
 Bakauan-babae, 287.
 Bakauan-gubat, 287.
 Balatong, 357.
 Balatong-aso, 288, 295.
 Balbalulang, 348, 359.
 Baléte, 281, 324.

Balimbing, 284.
 Balinghasai, 285.
 Balsaminaceæ, 286, 293.
 Balubar, 284.
 Baluong, 324.
 Bamboo, 279.
 Bambusa spinosa Roxb., 327.
 vulgaris Schrad., 279.
 Banaba, 287.
 Banago, 286.
 Banato, 285.
 Banlot, 324, 325, 327.
 Banuyo, 284.
 Barbados gooseberry, 351.
 Baslay, 326, 327.
 Baston de San Jose, 280.
 Batino, 288.
 Bauhinia malabarica Roxb., 283, 358.
 Bawang, 280.
 Bayabas, 349; pula, 360; pute, 360.
 Beans, red kidney, 345, 357; bountiful, 357.
 Beef, 263, 266; brain, 271; (cooked) liver,
 269; cuts of, 265; heart, 271; kidney,
 269; lungs, 269; spleen, 270; stomach,
 271; tongue, 270.
 Begonia acuminatissima Merr., 287.
 Begoniaceæ, 287, 293.
 Berbenaceæ, 296.
 Biga, 279.
 Bignai, 285.
 Bignay, 349, 360.
 Bignonia, 290, 294, 296.
 Bignoniaceæ, 290, 293, 296.
 Bihon, 344; luto, 355.
 Bikas, 291.
 Binuñga, 285.
 Binurong, 327.
 Biophytum sensitivum (Linn.) DC., 284.
 Bitag guttiferae, 287.
 Bixa orellana Linn., 287, 296.
 Bixaceæ, 287, 293, 296.
 Black night shade, 347, 359.
 Blumea balsamifera (Linn.) DC., 291.
 lacera (Burm.) DC., 291.
 Boehmeria nivea (Linn.) Gaud., 281.
 Bohok ni Ester, 280, 294.
 Boiginæ, 189.
 Bombaceæ, 286, 293.
 Bombax ceiba Linn., 286.
 Boraginaceæ, 289, 293.
 Botete, 282.
 Botobotonis, 285, 295.
 Botobotonisan, 291.
 Botolan, 285, 295.
 Bottle-brush tree, 287, 296.
 Bougainvillea spectabilis Willd., 282.
 Bougainvillea, 337.
 Bowerbankia gracilis aggregata, 337.
 Bowstring hemp, 280.
 Brassica chinensis, 282.
 oleracea Linn., 282.
 Bredilia stipularis Blm., 285.
 Bromeliaceæ, 280, 292, 294.
 Brugiera cylindrica Blm., 287.

- Brunettia, 205.
 ishiharai Tok. et Ets., 206.
 spinistoma Tok. et Ets., 206.
 Bryonopsis laciniosa (Linn.) Naud., 290.
 Buchanania arborescens Blm., 285.
 Bulak, 286.
 Bulakan, 289.
 Bunga, 279.
 Bungarus, 200.
 Buntot-pusa, 289, 296.
 Burseraceæ, 284, 293.
 Busogan, 326.
- C**
- Cabbage, coconut bud or, 349.
 swamp, 347, 359.
 Cacao, 286.
 Cactaceæ, 287, 293.
 Cactus cochinellifera (Linn.) Salm-Dyck, 287.
 lepidotus Linn., 287.
 triangularis F. Vill., 287.
 Cadena de Amor, 281.
 Caesalpina crista Perk., 283, 295.
 sappan Linn., 283.
 Caladium bicolor (Ait.) Vent., 279.
 Calamus Merrillii Bec., 325.
 Callicarpa bicolor Schauer, 289, 296.
 Callistemon lanceolatus DC., 287, 296.
 Calocarpum sapota (Jacq.) Merr., 361.
 Calophyllum inophyllum Linn., 287.
 Camagong, 288.
 Campanilla, 288.
 Campanulaceæ, 291, 293, 296.
 Campyloneuron, 463.
 Canadian elder, 290.
 Cananga odorata (Ham.) Hook. f. & Thomas, 282.
 Canarium luzonicum (Blm.) Gray, 284.
 CANCHELA, GUILLERMINA V., AND AURELIO O. CRUZ. Dehydration of castor oil for paints and allied products using local dehydrating materials, 303.
 Canna indica Linn., 280.
 Cannaceæ, 280, 292.
 Canthium monstrosum (Rich.) Merr., 290.
 Capparidaceæ, 282, 293, 295.
 Caprifoliaceæ, 290, 293.
 Carabao, 263, 267, 271; brain, 271; kidney, 269; large intestines, 270; liver, 269; lungs, 269; omasum, 270; reticulum, 270; small intestines, 270; spleen, 270; stomach, 271.
 Carallia brachiata (Lour.) Merr., 287.
 Carica papaya Linn., 287, 296.
 Caricaceæ, 287, 293, 296.
 Carthamus tinctorius Linn., 291.
 Cashew, 347, 359, 360; fruit, 350.
 Cassava flour, 345, 357.
 Cassia alata Linn., 283.
 bacillaris (Linn.) f., 283.
 fistula Linn., 283.
 sophera Linn., 283, 295.
 tora Linn., 283, 295.
 Castor oil for paints and allied products using local dehydrating materials, dehydration of, 303.
 Casuarina equisetifolia Linn., 281.
 Casuarinaceæ, 281, 292.
 Catmon, 286.
 Cayratia trifolia (Linn.) Quis., 286.
 Celastraceæ, 285, 293, 295.
 Celery, 288.
 Celosia argentea Linn., 282.
 cristata Linn., 282.
 Celtis luzonica Warb., 281.
 Centrosema plumier (Turp.) Benth., 283.
 Cereals, 352.
 Cestrum nocturnum Linn., 289.
 Chaang-gubat, 289.
 Chamulgra, 287.
 Chenopodiaceæ, 282, 293.
 Chenopodium ambrosioides Linn., 282.
 Chichirica, 288.
 Chicken, 263, 265, 268; gizzard, 269; liver, 269.
 Chico, 288.
 Chrysalidocarpus lutescens Wendl., 279.
 Chrysanthemum sinense Sab., 291.
 Chrysophyllum caimito Linn., 288, 360.
 Cissapelos pareira Linn., 282.
 Citrus grandis Osb., 284, 295.
 hystrix DC., 284.
 nobilis Lour., 284.
 Citryllus vulgaris Schrad., 290, 296, 358.
 Clausena anisum-olens (Blco.) Merr., 284.
 Cleome acutifolia Elm., 282.
 spinosa Jacq., 282.
 viscosa Linn., 282.
 Clerodendron calamatosum Linn., 289.
 intermedium Cham., 289.
 thomsonæ Balf., 289.
 Clytocyclus Eat., 221.
 Cobra antivenin, 190.
 Cocohoney, 357.
 Coconut shoot, 360.
 Cocos nucifera Linn., 279, 360.
 Codiaeum variegatum Blm., 285, 295.
 Cogon, 279.
 Coleus amboinicus, 289.
 blumei Benth., 289.
 Colocasia esculenta (Linn.) Schott. and Endl., 280.
 Colona blancoi Merr., 286.
 Coluber platurinus, 199, 200.
 Combretaceæ, 287, 293.
 Commelinaceæ, 280, 292.
 Compositæ, 291, 293, 294, 297.
 CONCEPCION, ISABEL, *see* INTENGAN, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, HENSON, and CONCEPCION, *See also* INTENGAN, CONCEPCION, ALEJO, VELONA, CORPUS, SALUD, DEL ROSARIO, GOMEZ, and HENSON.
 Connaraceæ, 283, 293.
 Convolvulaceæ, 288, 293.
 COPELAND, EDWIN B. Ctenopteris in America, 381; New Philippine ferns, XI, 161.

- Corazon de Maria, 279.
 Corchorus capsularis Linn., 286.
 Corculum leptopus (Hook. & Arn.) Stuntz., 281.
 Cordyline fruticosa (L.) A. Chev., 280.
 Corn, 345; cooked, yellow meal, 356; cooked, white meal, 356.
 Corona de espinas, 235.
 Coronitas, 289.
 Corophium shoemakeri Monod, 335-337.
 CORPUS, VELONA A., *see* INTEGAN, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, HENSON, and CONCEPCION. *See also* INTENGAN, CONCEPCION, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, and HENSON.
 Cosmos candatus HBK., 291.
 Costus clemensæ Ridl., 280.
 sericeus Blm., 280.
 Cow, blood, 270; large intestines, 270; mammary, 271; omasum, 270; reticulum, 270; small intestines, 270; uterus, 269.
 Cowpeas, black eye, new era, 358.
 Crassulaceæ, 283, 293.
 Crepis japonica (Linn.) Benth., 291.
 Crinum latifolium Linn., 280.
 Crossandra undulataefolia Sal., 290.
 Cruciferae, 282, 293.
 CRUZ, AURELIO O., *see* CANCHELA and CRIZ.
 Cryptosorus, 381.
 Dionaea, 381.
 Ctenopteris, 381, 382, 396, 404, 405, 414, 433, 440, 457, 463.
 achilleifolia (Kaulf.) J. Sm., 401, 404.
 albidula, 468.
 Alfarii (Donn.-Sm.) Copel., 428, 433, 439.
 allosuroides (Ros.) Copel., 383, 396.
 alsophilicola (Christ) Copel., 415, 423.
 ambigens (Max.) Copel., 457, 458, 460.
 anfractuosa (Kze.) Copel., 382, 428, 431, 432.
 angustipes Copel., 401, 404.
 antioquiiana (Bak.) Copel., 429, 442.
 apiculata (Kze.) Copel., 415, 417.
 aromatica (Max.) Copel., 415, 418, 457.
 assurgens (Max.) Copel., 382, 386, 387.
 athyrioides (Hook.) Copel., 401, 406.
 atroviridis Copel., 458, 461.
 attenuatissima Copel., 453, 456.
 brevistipes (Mett.) Copel., 429, 441.
 calva (Max.) Copel., 382, 386.
 capillaris (Desv.) Copel., 402, 403, 408, 414.
 celebicum, 381.
 Chases Copel., 414, 416.
 Chrysleri (Proct.) Copel., 443, 443.
 ciliaris (Fée) Copel., 415, 425.
 ciliolopsis (C. Chr.) Copel., 383, 395.
 cuencana (Hieron.) Copel., 383, 396.
 congesta Copel., 383, 397.
 contacta Copel., 443, 447.
 cretata (Max.) Copel., 429, 436.
 curvata, 468, 469.
 decipiens J. Sm., 402.
 delicatula (Mart. & Gal.) J. Sm., 428, 435.
 depressa (C. Chr.) Copel., 428, 431.
 discolor (Hook.) J. Sm., 467, 469, 470.
 dissimulans (Max.) Copel., 414, 415, 416.
 dolorensis (Hieron.) Copel., 443, 449, 458.
 ecuadorensis (C. Chr.) Copel., 428, 434.
 Eggersii, 429.
 elastica (Bory) Copel., 415, 424, 426-428.
 epiphytica Copel., 428, 436.
 exornans (Max.) Copel., 443, 446, 447, 458.
 flabbaespora Copel., 453, 457.
 Fendleri Copel., 458, 463.
 firma J. Sm., 418.
 flabelliformis (Poiret) J. Sm., 398, 401.
 flexuosa (Max.) Copel., 428, 434.
 Glaziovii (Bak.) Copel., 414, 416.
 gracilis (Hook.) J. Sm., 402, 406, 460.
 gradata (Bak.) Copel., 429, 437.
 graveolens (Bak.) Copel., 402, 408.
 Herreræ, 467.
 heteromorpha (Hook. & Grev.) Copel., 402, 412.
 Homberslevi (Max.) Copel., 428, 430.
 humilis (Mett.) Copel., 383, 393.
 in America, 381.
 isidrensis Copel., 429, 441.
 itatimensis (C. Chr.) Copel., 398, 399.
 jamesonioides (Fée) Copel., 414, 416.
 Jenmani (Underw.) Copel., 429, 442.
 jubaeforme, 440.
 jubaeformis (Kaulf.) J. Sm., 382, 388.
 Kalbreyeri (Bak.) Copel., 458, 465, 466.
 kaietura (Jen.) Copel., 429, 439.
 Knightii Copel., 415, 419.
 kookenamae (Jen.) Copel., 458, 461.
 lanigera (Desv.) Copel., 415, 429.
 lehmanniana (Hieron.) Copel., 443, 448, 458.
 leptostoma (Fée) Copel., 415, 421, 422.
 leucosticta J. Sm., 456.
 longa (C. Chr.) Copel., 452, 453, 454.
 longipinnata Copel., 457, 459.
 longisetulosa Copel., 458, 461.
 longiuscula (C. Chr.) Copel., 458, 456.
 major Copel., 453, 455.
 Maxonii, 458.
 Mayoris (Ros.) Copel., 458, 460.
 megaloura Copel., 383, 391.
 melanopus (Grev. et Hook.) Copel., 401, 404.
 melanosticta (Kze.) Copel., 382, 385.
 melanotricha (Bak.) Copel., 428, 430.
 meridensis (Kl.) Copel., 458, 461, 463, 464, 466.
 militaris (Max.) Copel., 383, 393.
 mollissima (Fée) Copel., 415, 423.
 moniliformis (Lag.: Sw.) J. Sm., 382-384, 387, 388, 390, 397.

Ctenopteris—Continued.

- myriophylla* (Mett.) Copel., 402, 412.
nubigena (Max.) Copel., 402, 409.
nudicarpa Copel., 458, 462, 464.
nudipes Copel., 401, 405.
obovata Copel., 429, 442.
oreophila (Max.) Copel., 452, 454.
patentissima (Mett.) Copel., 428, 457, 459.
pendula (Sw.) J. Sm., 428, 429, 442.
Pennellii Copel., 383, 397.
peruviana (Desv.) J. Sm., 382, 385.
Phlegmaria (J. Sm.) Copel., 428, 435.
Pichinchae (Sod.) Copel., 453, 455.
pilosissima (Mart. & Gal.), 383, 390, 432.
podocarpa (Max.) Copel., 402, 414.
pseudocapillaris (Ros.) Copel. 402, 407, 408, 410.
pseudonutans (Christ & Ros.) Copel., 383, 389, 397.
pteropus J. Sm., 411.
Randallii (Max.) Copel., 429, 438, 439.
reclinata (Brack.) Copel., 415, 424, 428.
Rhizophorae Copel., 415, 425.
rigens (Max.) Copel., 415, 422.
rigescens (Bory) J. Sm., 382, 385, 387, 397.
Rosarum copel., 382, 387.
Schwackei (Christ) Copel., 428, 438.
simacensis (Ros.) Copel., 428, 436.
semiadnata (Hook.) Copel., 457, 458.
semihirsuta (Kl.) Copel., 443, 450, 456.
senilis (Fée) Copel., 398, 400.
sericeo-lanata (Hook.) Copel., 443, 452, 453.
Sodiroy (Christ et Ros.) Copel., 383, 392.
Stella Copel., 443, 452.
subcapillaris (Christ) Copel., 383, 392.
subimpressa Copel., 458, 463.
subinaequalis, 431.
subflabelliformis (Ros.) Copel., 398, 400.
subsessilis (Bak.) Copel., 402, 411, 412.
subtilis J. Sm., 398-400.
suprasculpta (Christ) Copel., 402, 410.
suspensa (Linn.) Copel., 443, 445, 447.
Tamandarei (Ros.) Copel., 383, 394.
taxifolia (Linn.) Copel., 443, 447, 451.
tenuicula (Fée) Copel., 429, 439, 441.
Tmesipteris (Max.) Copel., 402, 410.
Truncorum (Lindm.) Copel., 443, 450.
Tunguraguae (Ros.) Copel., 383, 394.
Turrialbae (Chr.) Copel., 414, 419.
venulosa, 381.
vernica Copel., 443, 452, 458.
xanthotricha (Kl.) Copel., 415, 425.
yungensis (Ros.) Copel., 402, 407.
- Cyathaea arborescens* Copel., 162.
bikiranensis Copel., 162.
Cycadaceae, 279, 292.
Cycas rhumphii Miq., 279.
Cyclosorus magnus, 161.
polypterus Copel., 161.
aequinoctialis Linn., 294, 296.
Cymophyes Fieb., 8, 13, 19, 111-113, 121, 131, 150.
Cymophyes Leth. and Sev., 150.
Cymophyes Osh., 150.
Cymophyes Seide., 150.
Cymophyes Stål, 150.
decolor Leth. and Put., 153.
decolor Leth. and Sev., 153.
decolor Osh., 153.
decolor Put., 153.
decolor Seide., 153.
decolor Stål, 8, 151, 153, 154.
essabchana Seide., 8, 151, 155.
golodnajana Seide., 8, 151, 154.
ochroleuca Fief., 8, 150-152, 154.
ochroleuca Kirit., 152.
ochroleuca Lindb., 152.
ochroleuca Osh., 152.
ochroleuca Put., 152.
ochroleuca Seide., 152.
Cyperaceae, 279, 292, 365.
Cyperus flabelliformis Linn., 279.

D

- Dalunot, 281.
 Dama de noche, 289.
 Dampalit, 347, 358.
 Darak, 344, 355.
 Darangita, 284.
 Dark colored rice, raw, 355.
 Datiles, 286, 296, 350, 360.
 DEAN, JAMES, and GLADYS DEAN.
 The phonemes of Bilaan, 311.
 Deer, 263, 267.
 Deeringia amaranthoides (Lam.) Merr., 282.
 DE LEON, PACIENCIA, *See* MASILUÑGAN, MARAÑON, VALENCIA, DIOKNO, and DE LEON.
 DE RODA, A. P., F. SABILLO, and G. D ARCA YNA. Shigellosis I. An analysis of 445 cases of shigellosis, 253.
 DEL ROSARIO, ISABEL, *see* INTENGAN, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, HENSON, and CONCEPCION. *See also* INTENGAN, CONCEPCION, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, and HENSON.
 Dendropogon usneoides Linn., 280, 294.
 Derris elliptica (Roxb.) Benth., 283.
 trifoliata Lour., 283.
 Desmodium pulchellum (Linn.) Benth., 283.
 Dilang-aso, 291.
 Dilang-baka, 287, 291.
 Dillenia indica (Linn.) Indian, 286.
 Dilleniaceae, 286, 293.
 Dilophos Montr., 21.
 solieri Month., 21, 49, 83.

- DIOKNO, NATIVIDAD C., *see* MASILUNGAN, MARAÑON, VALENCIA, DIOKNO, and DE LEON.
- Dioscoraceae alata Linn., 280, 295.
- Discoraceae, 280, 292, 295.
- Diospyros ahernii Merr., 288.
discolor Willd., 288.
- Distolaca Baly, 237.
- Dita, 288.
- Ditiran, 282.
- DOMANTAY, JOSÉ S. Rectification of *Oscarella malabonensis*, a spongiomorphic mass formed by myriad of tiny animals, mostly tube-dwelling amphipods, polychaetes and turbellarians, 335.
- Doña Aurora, 290.
- Dos-amante, 280.
- Downesia Baly, 230, 233, 235, 237.
bambusae Mlk., 237.
javana Ws., 237.
- Drynaria quercifolia (Bory) J. Sm., 279.
quercifolia (Bory) Sm., 294.
- Duck, 263, 268; gizzard, 269; liver, 269; wild, 268.
- Duhat, 288, 292, 350, 360.
- Dumpalit, 358.
- Duranta repens Linn., 289.
- Durian, 346, 350, 360; seed, 358.
- Durio zibothinus Murr., 358.
- Dysophylla auricularia (Linn.) Blm., 289, 296.
- Dysoxylum decandrum (Blco.) Merr., 284.

E

- Ebenaceae, 288, 293.
- Edwardsia, 337.
- Egg, ant's, 351; duck's, 352; hen's, 351; turtle's 352.
- Eggs, ant, 363; duck (infertile), 363; duck (whole egg, raw), 363; duck (salted egg), 363; hen (white, yolk), 362; hen (whole egg, hard-boiled), 362; hen (whole egg, raw) 362; turtle (whole egg, yolk, white) 363.
- Ehretia microphylla Lam., 289.
- Ekagonia Mlk., 234.
- Elapinae, 189.
- Elapoides annulatus Sauv., 200, 201.
- Elecho, 279, 294.
- Elephantopus mollis HBK., 291, 294, 296.
- Endameba histolytica, 261.
- Enriched rice, cooked, 355; rice, raw, 355.
- Eriocaulaceae, 367.
- Eriocaulon, 365, 368, 373-375.
alpestre Hook. f. et Thoms., 367, 368.
alpestre (Hook f. & Thoms.), 368.
alpestre Hook. f. & Thoms. var. nigrum (Sat.) Koy., 368.
alpestre Hook f. & Thoms. var. robustus Max., 368.
atrum, 371.
australe R. Brown, 368.

- Buergerianum Korn., 368.
echinulatum Lec., 368.
echinulatum Mart., 368.
glabriflorum, 374.
hayatanum Koy., 369.
homotepalum Koy., 370.
kaikoense Masa., 373.
kaikoense (Masa. & Fuk.), 373.
lepidum Koy., 371.
nakayense Koy., 372.
nigrum Lec., 373.
nigrum var. fuscescens Koy., 373.
pachypetalum Hay., 368.
robustus (Max.) Mak., 368.
robustus var. nigrum Sat., 368.
seticuspe, 369.
Siebolotianum Sieb. et Zucc., 373.
ubonense Lec., 373, 375.
venopodium Koy., 374.
- Eronthum albomarginatum Hort., 290.
- Escherichia coli (Mig.) Cast. and Chal., 275-278, 291, 294, 297.
- Escobang lukluk, 286.
- Estrella, 291, 296.
- Eucalyptus tereticornis Sm., 288, 296.
- Eugenia polycephaloides Rob., 361.
- Euonymus javanicus Blm., 285, 295.
- Euphorbia nerifolia Linn., 285.
pilulifera Linn., 285, 295.
pulcherrima Willd., 285.
splendens Boj., 285.
- Euphorbiaceae, 284, 293-295, 297, 303.
- Eurycles amboinensis Linn., 280.

F

- FELIZARDO, M. L. The making of solar industrial salt in the Philippines, 177.
- Ficus elastica (Roxb.) Hort. & Beng., 281.
hauili Blco., 281.
minahassae Miq., 281.
nota (Blco.) Merr., 281.
sp., 324, 327.
stipulosa Mlk., 281.
ulmifolia Lam., 281, 295.
- Fistula, 283.
- Flacourtia ramontchi L'Herit, 287.
- Flacourtiaceae, 287, 293.
- Flemingia strobilifera (Linn.) Br., 283.
- Fluggea virosa (Roxb.) Bail., 285, 295.
- Fowls, 263, 265.
- Frog, 268.

G

- Gabi, 280.
- Gabi-gabihan, 280.
- Galo, 346; buto (luto), 358; buña at buto, 358.
- Ganophyllum falcatum Blm., 285.
- Garcinia mangostana Linn., 287.
- Gardenia augusta (Linn.) Merr., 290.
pseudopsidium (Blco.) f. Vill., 290.
- Gigna sinensi Linn., 284.
- Gliricidia sepium (Jacq.) Steud., 360.

- Glochidion philippicum* (Cav.) Rob., 285.
Glutinous rice, raw, 355.
Glycine max (Linn.) 357.
 Gnetaceæ, 279, 292, 294.
Gnetum gnemon Linn., 279, 294.
 Goat, 263, 267; heart, 271; kidney, 269;
 large intestines, 270; liver, 269; lungs,
 269; meat, 264; small intestines, 270;
 stomach, 271.
 Golden shower, 283.
 GOMEZ, ROSARIO, *see* INTENGAN, ALEJO,
 CORPUS, SALUD, DEL ROSARIO, GOMEZ,
 HENSON, and CONCEPCION. *See also*
 INTENGAN, CONCEPCION, ALEJO, COR-
 PUS, SALUD, DEL ROSARIO, GOMEZ, and
 HENSON.
Gonocaryum calleryanum (Baill.) Bec., 285.
Gonophora Chev., 230-240.
 angusta Gest., 237.
 bakeri Uh., 238, 239.
 bengalensis Ws., 231.
 femorata Ws., 234, 237-239.
 integra Baly, 240.
 linkei Uh., 238.
 mindoroica Uh., 237, 238.
 mjöbergi Uh., 236.
 nitidicollis Gest., 238.
 pulchella, 231.
 xanthomela Wied., 231.
 Gonophorini, 229, 232, 233, 235.
 Gonophorites, 237.
 Goose, 263, 265, 268; gizzard, 269; liver,
 269.
Gossypium sp. Linn., 286.
Gouania javanica Linn., 286.
 Gramineæ, 279, 292, 294.
 Grammitis, 382, 433.
 Grape, 286.
Graptophyllum pictum (Linn.) Griff., 290.
 Guamachil, 350, 360.
 Guava, 292.
 Guavas, 349; red, 360, white, 360.
 Gugulangun, 285.
 Gumamela, 349, 360.
 Guna, 324.
 Gusa, 326.
 Guttiferæ, 287, 293.
Gynura acuminatissima Merr., 291.
 angulosa F. Vill., 290.

H

- Hagimit, 281.
 Halu, 324.
 Hanggod, 282, 295, 347, 358.
Harpullia arborea (Blm.) Rdlk., 286.
 Hauli, 281.
Hedychium coronarium Koen., 280.
Helianthus annuus Linn., 291.
Helmintostachys zeylanica (Linn.), 359.
Helonotocoris Leth., 137.
 modigliani Leth., 111, 134, 135.
Helonotus Provanch., 137.
Helonotus Uhl., 137.
 abbreviatus Provanch., 140.
 abbreviatus Uhl., 140.
 HENSON, JESUSA, *see* INTENGAN, ALEJO,
 CORPUS, SALUD, DEL ROSARIO, GOMEZ,
 HENSON, and CONCEPCION. *See also*
 INTENGAN, CONCEPCION, ALEJO, COR-
 PUS, DEL ROSARIO, GOMEZ, and HEN-
 SON.
 Heterogonium, 162.
 Hierba buena, 289.
 Hilabagting, 289.
 Hingongoto, 285.
 Hinlaumo, 285, 295.
Hibiscus rasasinenses Linn., 360.
 Hispinæ, 231, 232.
Homalopsis buccatus Hall., 200, 201.
Homolanthus populens (Geisel.) Pax., 285.
Homonoia riparia Lour., 285.
Hydnocarpus alkalae C., 287.
 Hydrinæ, 189.
Hyptis brevipes Poir., 289, 296.

I

- Ibid*, 324.
 Icacinaceæ, 285, 293.
 Igat-igat, 286.
 Ihalas na baboy, 324.
 Ikmo, 281.
 Ilang-Ilang, 282.
Impatiens balsamina Linn., 286.
Imperata cylindrica (Linn.) Bauv. var.
 Koenigi, 279.
Indigofera suffruticosa Mill., 283, 295.
 INTENGAN, CARMEN LL., ISABEL CON-
 CEPCION, LEON G. ALEJO, VE-
 LONA A. CORPUS, ROSITA D.
 SALUD, ISABEL DEL ROSARIO,
 ROSARIO GOMEZ, and JESUSA
 HENSON. Composition of Philippine
 foods, IV, 343.
 INTENGAN, CARMEN LL., LEON G.
 ALEJO, VELONA A. CORPUS,
 ROSITA D. SALUD, ISABEL DEL
 ROSARIO, ROSARIO GOMEZ, JE-
 INTENGAN, CARMEN LL., ISABEL CON-
 CEPCION. Composition of Philippine
 foods, III, 263.
Intsia bijuga (Colebr.) Kze., 283, 295.
 Ipil, 283, 295.
 Ipil-Ipil, 283.
Ipomoea aquatica Korsk., 288.
 batatas (Linn.) Poir., 288.
 hederaceae (Linn.) Jacq., 289.
 purpurea Linn., 289.
 reptans (Linn.) Poir., 359.
 triloba Linn., 289.
 Isang dakut na bigas, 281.
Ischnodemus pallidipennis Stål, 109.
 Isis, 281, 295.
Isotoma longiflora (Mill.) Presl. 291, 296.
Ixora coccinea Linn., 290.
 finlaysonianana var. Wall., 290.

J

- Jaboticaba, 350, 361.
 Jacobina coccinea Benth., 290.
 Jamesonia adnata Kze., 383, 384.
 Jasmin, 288.
 Jasminum grandiflora Linn., 288.
 sambac (Linn.) Ait., 288.
 Java plum, 350, 360.
 Javeta Baly, 234.
 crassicornis Gest., 234.
 flavida Gest., 234.
 kerremansi Gest., 234.
 manicata Gest., 234.
 pachycera Gest., 234.
 Justicia gendarussa Burm. f., 290.

K

- Kabuyan, 284.
 Kadayohan, 282.
 Kaimito, 350; murado, 360.
 Kakawati, 349, 360.
 Kalaad, 282.
 Kalabasa, 290.
 Kalimatas, 282.
 Kalios, 295.
 Kalit-kalit, 286.
 Kalpueng, 290.
 Kalumbibit, 283, 295.
 Kamagsa, 283.
 Kamanchili, 184, 295, 350, 360.
 Kamangi, 284.
 Kamansi, 281.
 Kamantigi, 286.
 Kamariang-sungsong, 289.
 Kamatis, 289.
 Kamia, 280.
 Kamias, 284.
 Kamokamotihan, 289, 347, 359.
 Kamote, 288.
 Kamoteng kahoy, 285; arina, 345.
 Kamuning, 284, 295.
 Kandikandilaan, 289.
 Kangkong, 288, 347, 359.
 Kapanitulot, 290.
 Kasopangil, 289.
 Kasubha, 291.
 Kasuy, 350, 359, 360.
 Katungal, 280.
 Katurai, 284.
 Kayumanis, 284.
 Kinarlos rice, raw, 355.
 Kleinhobia hospita Linn., 286.
 Klitispa Uh., 230, 232, 235.
 Kodium tenue Kuetz., 359.
 KOMYO, ETSUKO, *see* TOKUNAGA and
 KOMYO.
 Kosibeng, 286.
 KOYAMA, TETSUO. The order Xyridales
 of Dr. Hayata's collection, 365.
 Kulasi, 287.
 Kulatigan, 286.
 Kulot, 348, 359.

- Kulotan, 286.
 Kulutkulutan, 286.
 Kupang, 284.
 Kutsarita, 294, 347; pula, 359.

L

- Labanus, 282.
 Labayo, 286.
 Labiatae, 299, 293, 296.
 Lachnispia Gest., 236, 239, 240.
 Lactuca sativa Linn., 291.
 Lagerstroemia indica Linn., 287.
 speciosa Linn., 287.
 Lagsaw, 324.
 Lagunding-dagat, 289.
 LAMANNA, CARL, *see* REYES and LA-
 MANNA.
 Lamb, 263, 267; brain, 271; heart, 271;
 kidney, 269; spleen, 270.
 Lamog, 287.
 Lansium domesticum Corr., 284.
 Lantana camara Linn., 289.
 Lanzones, 284.
 Lapnis, 286.
 Lasiochila Ws., 233.
 Lauraceae, 282, 293.
 Laurencia seticulosa (Forsk.) Brev., 359.
 Lechuga, 291.
 Lecythidaceae, 287, 293.
 Leguminosae, 283, 293-295, 297.
 Leonurus sibiricus Linn., 289.
 Leucaena glauca (Linn.) Benth., 283.
 Leucosyke-Art, 169, 175.
 angusta M. Unruh, 167.
 benguetsensis M. Unruh, 167, 169.
 brunnescens var. eubrunnescens, 169.
 brunnescens C. B. Rob. var. eubrunnes-
 cens M. Unruh, 168, 169.
 capitellata-Stück, 172.
 capitellata (Poir.) Wedd. var. celtidi-
 folia (Gaud.) Wedd., 170.
 capitellata (Poir.) Wedd. var. falcata
 (Bl.) Wedd., 170, 171.
 capitellata (Poir.) Wedd. var. eu-capi-
 tellata M. Unruh, 168-170.
 capitellata (Poir.) Wedd. var. villosa
 (Bl.) Wedd., 171, 172.
 Elmeri M. Unruh, 173.
 hispidissima (Wedd.) Miq., 175.
 nivea C. B. Rob., 167.
 ovalifolia, 173-176.
 samarensis M. Unruh, 172.
 samarensis var. aspera, 173.
 Weddellii, 174.
 Weddellii M. Unruh var. acuminata M.
 Unruh, 173-175.
 Weddellii M. Unruh var. eu-weddellii
 M. Unruh, 173.
 LEVITON, ALAN E. Systematic notes on
 the Asian snake Lycodon subcinctus,
 195.
 Liliaceae, 280, 292, 295.
 Limnocharis humboldti Rich., 282.

Lipoti, 350, 361.
 Lirio, 280.
 Litiran, 286.
 Litlit, 281, 295.
 Livistona sp., 324.
 Lochnera rosea (Linn.) Recib., 288.
 Lomagramma cordata Copel., 162.
 Lotus, 345.
 Lubi-lubi, 347, 359.
 Lucuma nervosa DC., 288.
 Luffa cylindrica (Linn.) Roem., 290.
 Luha, 285, 295.
 Luiang-usiu, 280.
 Lumbang, 284.
 Lumitzera racemosa Willd., 287.
 Lycodon albofuscus, 201.
 auleicus, 201.
 subcinctus, 195, 198-202.
 subcinctus sealei Lev., 195, 199, 201.
 subcinctus sealei, scale counts and measurement of specimens of, 198.
 subcinctus maculatus (Cope), 195, 196, 199, 201.
 subcinctus subcinctus Boie, 195, 199, 201.
 Lycopersicum esculentum Mill., 289.
 Lygadium circinnatum (Burm.) Sw., 327, 328.
 Lygaeidae, 1.
 Lygaeus crassimanus Fabr., 92.
 Lythraceae, 287, 293.

M

Macaranga tanarius Linn., 285.
 Macaroni, 344; luto, 356.
 MACEDA, MARCELINO N., see RAHMANN and MACEDA.
 Macroglena flavo-fusca, 163.
 obtusa Copel., 163.
 Maesa sp., 288.
 Magabuyo, 281.
 Magilik, 289.
 Magninus Dist., 7, 13, 15, 19, 20, 107.
 typicus Dist., 7, 107, 108.
 Maguey, 280.
 Mais, 345; dilaw, giniling, 356; dilaw, luto, 356; puti, giniling, 356; puti, luto, 356.
 Makabuhay-puti, 282.
 Makahiya-lalaki, 284.
 Makopa, 288.
 Malabayabas, 290.
 Malabulak, 286.
 Malacacao, 286.
 Malachra capitata Linn., 286.
 Malatapai, 285.
 Malaubi, 281.
 Malauiin-aso, 289.
 Malaulasiman tagpo, 290.
 Mallotus philippensis (Lam.) Muell.-Arg., 285.
 Mallugo oppositifolia Linn., 359.
 Maluñgay, 283, 292, 295.
 Malvaceae, 286, 293, 294, 297.
 Malvastrum coromandelinum Garck., 286.
 Malvaviscus grandiflora Linn., 286.
 Mamalis, 283, 295.
 Mangifera indica Linn., 285, 359, 361.
 Mango, 350; green, 361; halfripe, 361; ripe, 361; tops, 359.
 Mangostan, 287.
 Manihot esculenta Gr., 285.
 utilisima Pohl., 357.
 Maoutia, 174, 175.
 Marang, 346, 350, 361; seed (cooked), 358.
 MARAÑON, JOAQUIN, see MASILUNGAN, MARAÑON, VALENCIA, DIOKNO, and DE LEON.
 Maranta arundinacea Bleo., 280.
 Marantaceae, 280, 292.
 Maraotong, 284.
 MASILUNGAN, VICTORIA A., JOAQUIN MARAÑON, VICENTA V. VALENCIA, NATIVIDAD C. DIOKNO, and PACIENCIA DE LEON. Screening of Philippine higher plants for antibacterial substances, 275.
 Matamis na bao, 357.
 Matang-araw, 284.
 Mayana, 289.
 Megalops Hall., 200.
 Megalops maculatus, 201.
 Melanolepis multiglandulosa (Reinw.), 285.
 Melendres, 287.
 Meliaceae, 284, 293.
 Melicope triphylla (Lam.) Merr., 284.
 Melochia umbellata Houtt., 286.
 Menispermaceae, 282, 293.
 Mentha arvensis Linn., 289.
 Merremia gemella (Burm. f.), 289.
 peltata (Linn.) Merr., 289.
 Mezoneurum latisiliquum (Cav.) Merr., 283.
 Micrispa Gest., 235, 240.
 Micrococcus aureus Zopf., 275-278, 291, 294, 297.
 Mikania scandens (Juss.) Rohr., 291.
 Milagrosa rice, raw, 355.
 Milo, 324.
 Mique, 344, 355; luto, 356.
 Mirabilis jalapa Linn., 282.
 Misua, 344; luto, 355, 356.
 Molave, 289.
 Momordica cochinchinensis (Lour.) Spr., 290.
 Monagonia Uh., 230, 235.
 Moraceae, 281, 292, 294, 295, 297.
 Morado, 280.
 Moringa oleifera Lam., 282, 292, 295.
 Moringaceae, 283, 293, 295.
 Morning glory, 289.
 Morus alba Linn., 281.
 Meuhlenbeckia platyclada Meism., 282.
 Mungo bean, 346, 358.
 Muntingia calabura Linn., 286, 296, 360.
 Mulberry, 281.
 Murraya paniculata (Linn.) Jack., 284, 295.
 Musa sapientum Linn., 280.
 textilis Née, 280.
 Musaceae, 280, 292.
 Mussaenda philippica var. aurora Sulit, 290.

Mycobacterium tuberculosis, 276.
Myctaginaceæ, 282.
Myrsinaceæ, 288, 293.
Myrtaceæ, 287, 293, 296.

N

Naja, naja, 189, 193.
Narra, 284; prickly, 284.
Nasturtium aquaticum Linn., 359.
Neriedæ, 336.
Nicotiana tabacum Linn., 289.
Niog, 279.
Niog-niogan, 289, 296.
Nito, 327.
Noodle, 344; cooked, 355; raw, 356.
Noodles, 355; cooked, 355.
Nothopanax cordifolia Linn., 288.
 fruticosum (Linn.) Miq., 288.
 quillfoyle (Cogn. & Mar.), 288.
Nyctaginaceæ, 293.
Nymphaea stellata Willd., 282.
Nymphaeaceæ, 282, 293.

O

Obelia, 337.
Oedancala Amy. & Serv., 7, 17, 19, 20, 25,
 38, 41, 84-86, 94.
Oedancala Barb., 84, 97, 101, 107.
Oedancala Blatch., 84.
Oedancala Leth. & Serv., 84.
Oedancala Prov., 84.
Oedancala Stal., 84.
Oedancala T.B., 84.
Oedancala Us., 84.
Oedancala Van Duz., 84.
 bimaculata Dist., 7, 58, 86, 88, 94, 98,
 99, 101.
 crassimana Banks, 92.
 crassimana Barb., 93.
 crassimana (Fab.), 7, 85-87, 92.
 crassimana Heide., 92.
 crassimana Leth. and Sev., 92.
 crassimana Prov., 88.
 crassimana Slat., 93, 94, 97.
 crassimana Sm., 88.
 crassimana Stål, 88, 92.
 crassimana T. B., 88, 93.
 crassimana Uhl., 92.
 crassimana Van Duz., 92.
 cubana Banks, 92.
 cubana Barb., 95.
 cubana Gundl., 95.
 cubana Heide., 95.
 cubana Leth. and Sev., 95.
 cubana Stål, 7, 85-87, 95.
 cubana T. B., 95.
 cubana Uhl., 92.
 cubana Wol., 95.
 dorsalis Banks, 88, 92, 94, 95.
 dorsalis Barb., 89.
 dorsalis Blatchl., 89.
 dorsalis Briml., 89.
 dorsalis Drake, 88.
 dorsalis Froes., 89.

dorsalis group, 95.
 dorsalis Harr., 89.
 dorsalis Hendr., 89.
 dorsalis Huss., 88.
 dorsalis Montg., 88.
 dorsalis Morre, 89.
 dorsalis Osb., 88.
 dorsalis Parshl., 88.
 dorsalis (Say), 7, 86-88.
 dorsalis Slat., 89.
 dorsalis Sm., 88.
 dorsalis T. B., 89.
 dorsalis Uhl., 88.
 dorsalis Van Duz., 88.
 dorsilinea Amy. and Serv., 84, 92, 94.
 dorsilinea Barb., 92, 93.
 dorsilinea Berg., 90.
 dorsilinea Blatchl., 93.
 dorsilinea Briml., 93.
 dorsilinea Leth. and Sev., 88, 92.
 dorsilinea T. B., 93.
 dorsilinea Van Duz., 90, 92.
 dorsilinea Wirtn., 88.
 dorsilinea Wray and Briml., 93.
 husseyi Slat., 7, 88, 101.
 kormilevi Slat., 7, 86, 104.
 longirostris Slat., 7, 85-87, 101, 102.
 meridionalis Leth. and Sev., 90, 92.
 meridionalis Stål, 7, 85-87, 90, 97.
 mexicana Slat., 7, 85, 86, 105.
 nana Slat., 7, 84-87, 98, 101.
 notata Leth. and Sev., 105.
 notata Stål, 7-85-87, 94, 95, 98, 101, 105.
 notata T. B., 105.
 notata Van Duz., 105.
 pallidipennis Stål, 109.

Oleaceæ, 281, 292.
Oldenlandia corymbosa Linn., 290.
Oleaceæ, 288, 293.
Oncosperma horrida Schef., 326.
Onychium, 396.
Operculina turpethum (Linn.) Manso., 359.
Ophisthostenus Leth. and Sev., 113.
Ophisthostenus Reut., 113, 131, 150.
Ophites, 199.
 subcinctus Tayl., 201.
Opistholeptus Bergr., 8, 15, 17, 19, 111-113,
 119, 121, 123.
 burmanus Dist., 114, 115.
 burmanus burmanus (Dist.) Slat., 8,
 122.
 burmanus singalensis Bred., 8, 123.
 capeneri Slat., 8, 114, 116.
 chinai Slat., 8.
 elegans (Hesse) Slat., 8, 114-116.
Opistholeptus horvathi Slat., 8, 114, 123, 125.
 group, distribution of the genus, 16.
 jordani Slat., 8, 114, 127.
 key to the species of, 114.
 ochreipennis Leth. and Sev., 115.
 ochreipennis (Reut.), 8, 115, 119.
 ochreipennis Reut., 8, 113-115.
 pallidus (Hesse) Slat., 8, 111, 113, 114,
 119, 121.

parvus Slat., 8, 115, 128.
 vulturus (Kirk.) Slat., 8, 115, 126.
 Orchidaceæ, 280, 292.
 Oregano, 289.
 Oryza glutinosa Lour., 355.
 sativa Linn., 279, 355.
 Osa, 324.
 Oscarella Malabonensis, 335.
 Oxalidaceæ, 284, 293.

P

Paayap, 284, 346, 358.
 Pachygrontha Banks, 21.
 Pachygrontha Barb., 21.
 Pachygrontha Dist., 21.
 Pachygrontha Ger., 6, 10, 11, 15, 17, 20, 38,
 40, 52, 56, 83, 85, 97, 107, 109, 111.
 Pachygrontha Leth. and Sev., 21.
 Pachygrontha Osh., 21.
 Pachygrontha Stål, 21.
 Pachygrontha T. B., 21.
 africana Slat., 7, 17, 25, 27, 78, 83.
 angularis Leth. and Sev., 83.
 angularis Reut., 7, 17, 83.
 angusta Leth. and Sev., 60.
 angusta Stål, 7, 59, 60.
 antennata Asah., 72.
 antennata Bergr., 72.
 antennata Esaki, 72.
 antennata Hutch., 72.
 antennata Leth. and Sev., 72, 75.
 antennata Lindb., 72, 75.
 antennata Mats., 72.
 antennata Osh., 72, 75, 77, 78.
 antennata Put., 13, 15, 24, 28, 75.
 antennata White, 72.
 antennata Stål, 72, 74.
 antennata Uhl., 72.
 antennata antennata (Uhl.), 7, 28, 72,
 74, 75.
 antennata group, 23, 25.
 antennata nigriventris Reut., 7, 28, 74,
 75.
 austrina Kirk., 6, 17, 22, 28, 29, 59, 61,
 62.
 barberi Slat., 6, 22, 24, 26, 31, 34-36,
 41, 44, 79.
 bakeri bakeri Slat., 6, 27, 43, 44.
 bakeri gracilis Slat., 6, 26, 43.
 bakeri group, 22, 50, 53.
 bicornuta Banks, 46, 47.
 bimaculata Banks, 99.
 bimaculata Barb., 99.
 bimaculata Dist., 41, 64, 99.
 bimaculata Leth. and Sev., 99.
 bimaculata T. B., 99.
 bimaculata Van Duz., 99.
 bimaculata Wol., 99.
 bipunctata Bergr., 64.
 bipunctata Leth. and Sev., 64.
 bipunctata Stål, 9, 13, 14, 17, 22, 23,
 29, 31, 64-67, 69.
 bipunctata bipunctata Stål, 6, 29.
 bipunctata incipiens Slat., 6, 29, 66, 67.
 bipunctata group, 17, 23.
 bipunctata group, distribution of, 16.
 brevicornis Horv., 51.
 brevicornis leth. and Sev., 51, 52.
 brevicornis Stål, 9, 51, 53.
 carinata Slat., 6, 26, 43, 44.
 compacta Dist., 6, 25, 37, 39-41, 84-86,
 98.
 compacta Leth. and Sev., 89.
 compacta Osb. and Drake, 39.
 compacta T. B., 39.
 confusa Dist., 9, 64-66.
 congoensis Slat., 7, 23, 29, 66, 67, 69.
 cruenta Bergr., 64, 65.
 dixonii Bred., 64.
 dixonii Dist., 64, 65.
 fusiformur Stål, 69, 70.
 grossa Slat., 6, 24, 26, 35.
 group, distribution of genus, 18.
 harrisii Slat., 6, 27, 43, 47, 50, 83.
 lestoni Slat., 6, 15, 23, 57.
 lewisi Bergr., 81.
 lewisi Dist., 7, 25, 28, 81, 83.
 lineata Ger., 7, 13, 21, 28, 69, 71.
 lineata Leth. and Sev., 69.
 lineata Stål, 69.
 lineata group, 13, 17, 22, 23.
 lineola Spin., 69.
 longiceps Barb., 24, 25, 29, 30.
 longiceps Dist., 29.
 longiceps group, 17, 24.
 longiceps Leth., 29.
 longiceps Singh-Pruthi, 29.
 longiceps Stål, 6, 29.
 longiceps T. B., 29.
 longiceps Uhl., 32.
 longicornis Dist., 51, 83.
 longicornis Leth. and Sev., 53, 54, 63.
 longicornis Stål, 6, 26, 43, 53.
 (sic) *longicornis* Leth., 53.
 lurida, 13, 22-24, 28, 59, 60.
 lurida lurida Slat., 7, 28, 53, 59.
 lurida yakuensis Slat., 7, 28, 59.
 luridus, 61.
 minarum Leth. and Sev., 6, 27, 31-33.
 miriformis Bred., 6, 22, 26, 43, 46.
 miriformis Bergr., 46, 47.
 nigriventris Bergr., 75.
 nigriventris Reut., 74, 75.
 nigrolineata Dist., 54-56.
 nigrovittata Dist., 54.
 nigrovittata Leth. and Sev., 54.
 nigrovittata Stål, 6, 15, 24, 54, 57, 59,
 74.
 nigrovittata group, 17, 23.
 obluctans Bergr., 54-55.
 œdancalodes Dist., 36.
 œdancalodes Stål, 25, 36, 40, 41, 84, 85.
 œdancalodes T. B., 36.
 œdancalodes Uhl., 36.
 œdancalodes carvalhoi Slat., 5, 38.
 œdancalodes group, 17, 25.
 œdancalodes œdancalodes Stål, 6, 25, 36.
 œdancaloides Barb., 36, 38.

- ædancaloides* Leth. and Sev., 36.
 of the eastern hemisphere, key to the species of, 26.
 of the western hemisphere, key to the species of, 25.
paralineata Slat., 7, 27, 71.
parvula Barb., 6, 41.
parvula Ram., 41.
parvula Wol., 41.
pseudolineata Slat., 7, 27.
quadripunctata Leth. and Sev., 62.
quadripunctata (Sign.), 7, 17, 23, 27, 62.
quadripunctata Stål, 62, 66.
robusta Slat., 7, 13, 15, 25, 29, 79.
saileri Slat., 6, 24, 26, 32.
semperi Stål, 6, 9, 26, 43, 51, 53, 54, 83.
 (sic) *semperi* Leth., 51.
similis Osh., 76.
similis Uhl., 7, 24, 28, 74, 76-78.
solieri Leth. and Sev., 83.
solieri (Montr.), 7, 83.
solieri Stål, 83.
sp., 43.
tabida Dist., 64.
tabida Leth. and Sev., 64.
tabida Stål, 64, 65.
 two types of, 19.
vidua Horv., 6, 27, 43, 49, 50.
walkeri Dist., 7, 25, 27, 28, 80.
 western hemisphere, 19.
Pachygronthinæ Barb., 10.
Pachygronthinæ Berg., 9.
Pachygronthinæ Dist., 10.
Pachygronthinæ Blatch., 10.
Pachygronthinæ Froesch., 10.
Pachygronthinæ Hutch., 10.
Pachygronthinæ Leth., 10.
Pachygronthinæ Osh., 10.
Pachygronthinæ Singh-Pruthi, 10.
Pachygronthinæ Stål, 1, 2, 6, 9, 136, 150.
Pachygronthinæ T. B., 10.
Pachygronthinæ Uhl., 9.
Pachygronthinæ Van Duz., 10.
 of the world, 1.
 Oriental, 43.
 world distribution of, 3.
Pachygronthini Banks, 10.
Pachygronthini Put., 10.
Pachygronthini Stål, 6, 12, 13, 19, 20, 109, 112.
Pachymerus crassimanus Herrich-Schaefer, 92.
Pachyplegyas Slat., 7, 19, 111, 112, 131, 133, 138.
modigliani (Leth.), 15.
modigliani ethiopicus Slat., 7, 136.
modigliani modigliani (Leth.), 7, 134.
Pachyrrhizus erosus (Linn.) Urb., 283.
Paipai-amo, 279, 284.
Pakaskas, 357.
Pako, 279.
Pakuwán, 290; *butó*, 296, 346, 353.
Palay, 279.
Palis, 289, 296.
Palma brava, 326, 327, 329.
Palmae, 279, 292.
Palo Santo, 281.
Palong-manok, 282.
Palutan, 287.
Paminta, 281.
Pana, 324.
Pandan, 279; *mabango*, 279.
Pandanaceæ, 279, 292.
Pandanus odoratissimus Linn., 279.
tectorius Sol., 279.
Pangi, 287.
Pangium edule Reinw., 287.
Panotsa, 357.
Papait, 359.
Papaya, 287, 296.
Papua, 288.
Papua-china, 288.
Parameria lævigata (Juss) Mold., 288.
Paraphlegyas Hesse, 111, 113, 119.
elegans Hesse, 113, 117.
namakundensis Hesse, 117, 118.
pallidus, 113.
Paristhmius Leth. and Sev., 129.
Paristhmius Reut., 8, 13, 17, 111, 112, 129, 131.
vitticollis Leth. and Sev., 130.
vitticollis Reut., 8, 130.
Parkia javanica (Lam.) Merr., 284.
Parosella glandulosa (Blco.) Merr., 284.
Parsley, 348, 359.
Pascuas, 285.
Patolang amerikano, 290.
Patolang-uak, 290.
Payang-payang, 283.
Payasan, 325.
Pechay, 282.
Pedilanthus tithymaloides Linn., 285, 295.
Peliopelta Dist., 137.
Peliopelta Uhl., 137.
abbreviata Blatchl., 140.
abbreviata MacGill. and Hourgh., 140.
abbreviata Montg., 140.
abbreviata Osb., 140.
abbreviatus Sm., 140.
abbreviatus Uhl., 140.
abbreviatus Van Duz., 140.
tropicalis Dist., 144.
Peliosoma antennata Uhl., 21.
Peperomia pellucida (Linn.) HBK, 281.
Peregil, 348, 359.
Pereskia aculeata, 361.
Pericoma Walk., 205, 221, 227.
avicularia Ton., 225.
canescens Meig., 225.
denticulatifyleta Tok. et Ets., 206, 223, 224.
furcastyla Tok. et Ets., 206, 225, 226.
longicellata Tok. et Ets., 206, 220.
neglecta Eat., 225.
omogoensis Tok. et Ets., 206.
reticulatipennis Tok. et Ets., 206, 221, 222.

- sasakawai Tok. et Ets., 206.
 shikokuensis Tok. et Ets., 206.
 yanoi Tok. et Ets., 206.
Petroselinum hortense Hoffm., 359.
Petunia, 289.
 hybrida Hort., 289.
Phaenanthus ebracteolatus (Presl) Merr., 282.
Phaseolus aureus Roxb., 358.
 vulgaris Linn., 357.
Phlebotominae, 205.
Phlebotomus squamirostris Hewst., 205.
Phlegyas Barb., 137.
Phlegyas Berg., 137.
Phlegyas Blatch., 137.
Phlegyas Bred., 137.
Phlegyas Caray., 137.
Phlegyas Dist., 138.
Phlegyas Leth. and Sev., 137.
Phlegyas Stål, 7, 17, 19, 111, 112, 131, 134, 136-138.
Phlegyas T. B., 137.
 abbreviatus Barb., 141.
 abbreviatus Blatchl., 141.
 abbreviatus Briml., 141.
 abbreviatus Hedr., 141.
 abbreviatus Huss., 141.
 abbreviatus Joh., 141.
 abbreviatus Proct., 141.
 abbreviatus Slat., 141.
 abbreviatus Sm., 141.
 abbreviatus T. B., 141.
 abbreviatus (Uhl.), 7, 138-140, 143, 144.
 abbreviatus Van Duz., 141.
 (sic) *abbreviatus* Moore, 141.
 annulicornis (sic) Banks, 141, 144.
 annulicrus Bar., 144, 145.
 annulicrus Blatchl., 144.
 annulicrus Briml., 145.
 annulicrus Downes, 141.
 annulicrus Hart, 141.
 annulicrus Leth. and Sev., 140, 144.
 annulicrus Parshl., 141.
 annulicrus Snow, 144.
 annulicrus Stål, 7, 138, 142-145.
 annulicrus T. B., 145.
 annulicrus Uhl., 144.
 annulicrus Van Duz., 144.
 annulicrus Wirtn., 141.
 burmanus Dist., 122-124, 138.
 group, distribution of genus, 18.
 key to the species of, 138.
 modigliani (Leth.), 138.
 modigliani Leth. and Sev., 134, 136.
 patruelis Berg., 7, 138, 139.
 patruelis Leth. and Sev., 139, 140, 143.
 tropicalis Banks, 144.
 tropicalis Leth. and Sev., 144.
 tropicalis T. B., 145.
 vulturnus Kirk., 126, 138.
Phyllanthus niruri Blec., 285, 295.
Pideos, 344, 355.
 Fig, blood, 270; large intestines, 270; small intestines, 270; suckling, 266; tongue, 270; uterus, 269.
 Pigeon, 263, 265, 268.
Pilea microphylla (Linn.) Liebm., 281.
Pili, 284.
Pinacæ, 279, 292.
Piper betle Linn., 281.
 loheri DC., 281.
 nigrum Linn., 281.
 retrofractum Vahl., 281, 295.
Piperacæ, 281, 292, 295.
Pipturus arborescens Link., 281.
Pistosia Ws., 230, 233, 235.
Pithecolobium dulce (Roxb.) Benth., 284, 295, 360.
Pittosporacæ, 283, 293, 295.
Pittosporum pentandrum (Blec.) Merr. 283, 295.
Pityrogramma calomelanos (Linn.) Link., 279, 294.
Planchonia spectabilis Merr., 287.
Plantaginacæ, 290, 293.
Plumbaginacæ, 288, 293.
Plumbago auriculata Lam., 288.
Polanisia icosandra (Linn.) W. & A. 294.
Poligosorum Mett., 401.
Poliosoma Uhl., 21.
 Polished rice, raw, 355.
Polygonacæ, 281, 293.
Polypodiacæ, 279, 292, 293.
Polypodium, 405, 463.
 achilleae-folium Kaulf., 404.
 acrodontium Fée, 390.
 acrosorum Kze., 455.
 albidulum Bak., 467.
 albopunctatum Bak. apud Jen., 436.
 Alfarii, 430, 433.
 allosuroides Ros., 396.
 alsophilicolum Christ, 423.
 alternifolium Hook., 420, 453.
 ambigens Max., 460.
 amphidasyon Kze., 471.
 anfractuosum apud Kl., 431, 432.
 angustissimum Fée, 383, 384.
 antioquianum Bak., 442, 443.
 apiculatum Kze., 417, 418, 455.
 arcuatum Mor., 448.
 aromaticum Max., 418.
 asplenifolium Linn., 444, 445.
 athyrioides Hook., 406.
 azuayense Sod., 416.
 Bakeri Lindm., 450.
 blandum Fée, 402, 403.
 bolivianum Ros., 442.
 brevistipes Mett. apud Kuhn, 441.
 brunneo-viride Bak. apud Jen., 464.
 calvum Max., 386.
 camptoneuron Fée, 462, 463.
 capillare Desv., 402, 407, 408.
 carnosulum Christ, 465.
 chiricanum Max., 411, 412.
 Chryssleri Proct., 448.
 ciliare Fée, 425, 426.
 ciliolepis C. Chr., 395, 437.
 confluens Fée, 418.

Polypodium—Continued.

- confusum J. Sm., 388.
 crassulum Max., 402, 403.
 cretatum Max., 436.
 crispulum Christ, 471.
 cuencanum Hieron., 395, 396.
 cultratum Bory: Willd., 426.
 cultratum Willd., 426.
 cultratum var. reclinatum, 424.
 curvans Mett., 466.
 curvatum Sw., 466, 467.
 curvatum fo., 467.
 decipiens Hook., 402, 403.
 degressum C. Chr. 431.
 delicatulum Mart. & Gal., 435.
 dependens Bak., 412, 413, 420.
 discolor Hook., 469.
 dissimulans Max., 415.
 dolorense Hieron., 448, 449.
 dominguense Br., 422.
 dulum var. gardnerianum Bak., 441.
 ecuadorensis C. Chr., 434, 455.
 Eggersii Bak., 445.
 elasticum Bory, 425, 426.
 ellipticosorum Fée, 425.
 euchlorum Kze., 411.
 exornans Max., 446.
 exsudans Christ, 471.
 farinosum Hook., 470.
 Fendleri Eat., 463.
 ferrugineum Mart. et Gal., 440.
 filicula, 464.
 firmum Kl., 418, 419.
 flabelliforme Hook., 398, 401.
 flexile Fée, 426.
 flexuosum Max., 434.
 fucoides Christ, 402, 403.
 funiculum Fée, 405, 407.
 glaziovii Bak., 416.
 gracile Hook., 406.
 gradatum Bak., 437.
 gradatum Fée, 450, 451.
 graveolens Bak., 409, 410.
 graveolens Bak. apud Jen., 408.
 Herzogii Ros., 418, 419.
 heteromorphum Hook. & Grev., 412, 413.
 heterotrichum Bak., 435.
 hirsutulum Fée, 437.
 Hombersleyi Max., 430.
 humile Mett., 393.
 Iaxo Presl, 421.
 immersum Fée, 431.
 inaequale Fée, 466.
 induens Max., 431, 432.
 isidrense Max., 441.
 jamesonioides Fée, 416.
 Jenmani Underw., 442.
 jubaeforme Kaulf., 388, 416, 440.
 kaleturum Jen., 439.
 kalbreyeri Bak., 465.
 koodenamae Jen. apud Bak., 461.
 lanigerum Desv., 420, 421.
 lasiolepis Jen., 442.
 lasiolepis Mett., 439.
 laxifrons Lieb., 446.
 laxum Presl, 420, 421.
 leptostomum Fée, 421.
 leveilleanum Desv., 426.
 longisetosum Hook., 405.
 lehmannianum Hieron., 448.
 Lehmannii Mett., 448.
 leucolepes Christ, 451.
 leucosticta Fée, 456.
 L'Herminieri Fée, 456.
 longipes Fée, 465.
 longiusculum C. Chr., 456.
 longum C. Chr., 453.
 Luederswaltii Ros., 468.
 melanopus Grev. et Hook., 404.
 melanostictum, 386.
 militare Max., 393.
 moniliforme Lag. apud Sw., 383, 385.
 moniliforme var. bogotensis Hieron., 385.
 moniliforme var. minus, 385.
 moniliforme var. rigescens Hook., 385, 387.
 myriophyllum Mett., 412.
 Manabyanum Bak., 460.
 Mayoris Ros., 460.
 melanotrichum Bak., 430.
 meridense Kl., 464.
 microphyllum Mett., 471.
 monticola Kl., 431, 432.
 mollissimum Fée, 423.
 Moritzianum Link., 471.
 nubigenum Max., 409, 410.
 obovatum Mett., 442.
 oligosorum Mett., 443.
 oligosorum Mor., 433.
 oreophilum Max., 451, 454.
 ovaescens Fée, 425.
 peruvianum Desv., 385.
 pilipes Hook., 402, 403.
 pilosissimum Mart. et Gal., 390, 395.
 Pseudonutans Christ & Tos., 389.
 pastoense C. Chr., 448.
 petentissimum Mett. apud Kuhn, 459.
 pearcei Bak., 467.
 pectinatum Linn., 471.
 pectinatum var. hispida Christ, 451.
 pendulum Sw., 429, 434, 442.
 pendulum var. boliviense Ros., 442.
 pendulum var. subsessile Bak., 411.
 Phlegmaria J. Sm., 435.
 Pichinchae Sod., 455.
 pichinchense Hieron., 455.
 pilosissimum, 422.
 Plumula HBW., 471.
 podocarpum Max., 414.
 pozuzoense Bak. apud Hook., 402, 403.
 pressum Br., 465.
 productum Max., 421, 422.
 pruinatum Bak., 470.
 pruinatum Max., 470.
 pulchrum Mart. et Gal., 463.
 pseudocapillare Ros., 407.
 pteropus Hook., 411.
 radicale Mor., 463, 464.

Polypodium—Continued.

- Randalli Max., 438.
 reclinatum Brack., 424.
 rigens Max., 422.
 rigescens Bory: Willd., 387, 388.
 regescens Jen., 422.
 saccatum Fée, 388.
 saxicola Ros., 399.
 saxicolum Bak., 431, 432.
 Schwackei Christ, 438.
 semiadnatum Hook., 458, 459.
 semihirsutum Kl., 450, 451.
 semihirsutum var. fuscetosa Hieron., 451.
 semiadnatum Hook., 426.
 senile Fée, 398.
 senile var. minor.
 sericeo-lanatum Hook., 453.
 simacense Ros., 436.
 Sodiroy Christ & Ros., 392.
 spixianum Mart. apud Mett., 464.
 Stiibeli Hieron., 395, 455, 471.
 subcapillare Christ, 392.
 suberenatum Hook., 383, 384.
 subdimidiatum Bak., 435.
 subinaequale Christ, 467, 468.
 sublongipes Christ, 471.
 subscabrum Hook, 434, 455.
 subscabrum Kl., 471.
 subsessile Bak., 411.
 subtile Kze., 400.
 subtile Kze. apud Kl., 399, 400.
 suprasculptum Christ, 410.
 suspensum Linn., 443-446.
 Tamandarei Ros., 394.
 taxifolium Auct., 451, 456.
 taxifolium Linn., 448, 448.
 tenuicolum Fée, 437, 439.
 tenuicolum var. acrosora Hieronv., 440, 445.
 tenuicolum var. brasiliense Ros., 440.
 tenuifolium Humb. & Bonpl., 462, 463.
 tenuisectum Hook., 412.
 towarense Kl., 435.
 transiens Lindm., 465.
 Truncorum Lindm., 450.
 Tunguraguæ Ros., 394.
 Turrialbæ Christ, 419.
 variabile Mett., 412, 413.
 venustum Desv., 447.
 vernicosum Max., 452.
 vulgare, 381.
 Waemingii C. Chr., 471.
 xiphopteroidaeifolium Jen., 471.
 xiphopteroides Lieb., 390.
 yungense Ros., 407, 408.
 zanthotrichium Kl., 425.
 Ponderosa, 351, 361.
 Pork, 263, 266; cuts of, 265; heart, 271; kidney, 269; liver, 269; lungs, 269; spleen, 270; stomach, 271.
 Premna cumingiana Schauer, 289.
 nauseosa Blec., 289.
 odorata Blec., 289, 292.
 subscandens Merr., 289.
 Prickly chaff flower, 347, 358.
 Prosaptia, 382.
 Prugtongahas, 288.
 Pseudelphantopus spicatus (Juss.) Rohr., 291.
 Pseuderanthemum reticulatum Radlk., 290, 296.
 Psidium guajava Linn., 292, 360.
 Psychoda Latr., 205.
 alternata Say, 206.
 erimineæ Eat., 206.
 fungicola Tok., 206.
 itoco Tok. et Ets., 206.
 logiseta Tok. et Ets., 206.
 malleola Tok. et Ets., 206.
 motoharui Tok. et Ets., 206.
 phalaenoides Eat., 206.
 setigera Ton., 206, 227.
 severini Ton., 206.
 Psychodidae, Japanese, 205.
 Psychodinae, 206.
 Psychotria luzoniensis Merr., 290.
 Pteridaceæ, 279, 292.
 Pteris blaurita Linn., 279.
 Pterocarpus indicus Willd., 284.
 vidalianus Rolfe, 284.
 Pterospermum obliquum Blec., 286.
 Pugo-lukós, 173.
 Pukpuklo, 348, 359.
 Pullet, 265, 268.
 Pumera dorsalis Say, 88.
 Puñgapon, 279, 294.
 Pygeum vulgare (Koch.) Merr., 283.
 Pyrrosia, 442.
 adnascens (Sw.) Ching, 279.
R
 Rabbit, 263, 267; liver, 269.
 RAHMANN, RUDOLF, and MARCELINO N. MACEDA. Bow and arrow of the Visayan Negritos, 323.
 Ramie, 281.
 Ramilad rice, cooked, 355.
 Raphanus sativus Linn., 282.
 Red variety rice, raw, 355.
 Repollo, 282.
 REYES, ARTURO C., and CARL LA-MANNA. Snakebite mortality in the Philippines, 189.
 Rhamanaceæ, 286, 293.
 Rhabdophora merrillii Engl., 280.
 Rheo discolor (L'Herit) Hance, 280.
 Rheum rhaponticum Linn., 360.
 Rhizophora mucronata Lam., 287.
 tinctoria Blec., 287.
 Rhizophoraceæ, 287, 293.
 Rhubarb, 349, 360.
 Rice, 343, polishes, 344; dark colored, 355; raw, 355; enriched cooked, 355; enriched, raw, 355; glutinous, raw, 355; kinarlos raw, 355; milagrosa, raw, 355; polished, raw, 355; polishes,

- 355; Ramlad, cooked; 355, red variety, raw, 355; unpolished, raw, 355; wag-wag, raw, 355.
- Ricinus Communis*, 303.
- Rimas, 281, 295.
- Rosaceæ, 283, 293.
- Rosal, 290.
- Rourea erecta* (Blco.) Merr., 283.
- Rubber tree, 281.
- Rubiaceæ, 290, 293.
- Rutaceæ, 284, 293, 295.
- S**
- Sabella, 337.
- SABILLO, F., *see* DE RODA, SABILLO, and ARCAÿNA.
- Sabungai, 291.
- Saccharum officinarum* Linn., 279, 294, 357.
- spontanæum* Linn., 279.
- Saga, 283.
- Saging, 280.
- Salago, 287.
- Salanum nigrum* Linn., 359.
- Salt in the Philippines, the making of solar industrial, 177.
- Salt-making data, technical, 184-188.
- SALUD, ROSITA D., *see* INTENGAN, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, HENSON, and CONCEPCION. *See also* INTENGAN, CONCEPCION, ALEJO, CORPUS, SALUD, DEL ROSARIO, GOMEZ, and HENSON.
- Saluyut, 286.
- Samanea saman* (Jacq.) Merr., 284.
- Sambong, 291.
- Sambucus canadensis* Linn., 290.
- Sampaguita, 288.
- Sampaloc, 292, 348-360; talbos, 359.
- Sampa-sampalocan, 285, 295.
- San Diego, 290, 296.
- San Francisco, 285, 295.
- Sandoricum Kœtjape (Burm. f.) Merr., 284, 361.
- Sansevieria zeylanica* Willd. var. *laurenti*, 280.
- Santan-dilaw, 290.
- Santan-pula, 290.
- Santol, 284, 351, 361.
- Sapang, 283.
- Sapindaceæ, 285, 293.
- Sapindus saponaria* Linn., 286.
- Sapotaceæ, 288, 293.
- Sapote, 351, 361.
- Sarracenia flava*, 95.
- Sarsalida, 347.
- Sarsaparilla, 280.
- Scoparia dulcis* Linn., 290.
- Scrophulariaceæ, 290, 293.
- Secreto de amor, 289.
- Sedum maxima* Suter., 283.
- Serpula, 337.
- Sesbania grandiflora* (Linn.) Pers., 284.
- Sesuvium portulacastrum* Linn., 358.
- Sheep, liver, 269; lungs, 269.
- Shigella, 253-259, 261.
- alkalascens*, 259.
- ambigua*, 258, 259.
- dysenteria*, 255, 258, 259, 261.
- flexneri*, 255, 258, 259.
- isolated, frequency of different types of, 255.
- sonnei*, 255, 258, 259, 261.
- Sibucaw, 327.
- Sibuyas Tagalog, 280.
- Sida acuta* Furm. f., 286.
- javensis* Cav., 286.
- retusa* Linn., 286.
- rhombifolia* Linn., 286.
- Silasila, 283.
- Silisilihan, 282.
- Sinagupit, 327.
- Singalong, 324.
- Siniguwelas, 285, 348, 351, 359, 361.
- Sinkamas, 283.
- SLATER, JAMES A. A revision of the subfamily *Pachygronthinæ* of the World (Hemiptera: *Lygaeidæ*), 1.
- Smilax china* Linn., 280.
- Snakebite mortality in the Philippines, 189.
- Snipe, 268.
- Solanaceæ, 289, 293.
- Soro-soro, 285.
- Spaeranthus alatus* Blaco., 291.
- Spanish plum, 348, 351, 359, 361.
- Spathodea campanulata* Beauv., 290.
- Sphaeranthus alatus* Blaco., 291.
- Spondias purpurea* Linn., 285, 359, 361.
- Squab, 268.
- Stachytarpheta jamaicensis* (Linn.), Vahl, 289.
- Star apple, 350, 360.
- Stenophyella* Bergr., 146.
- Stenophyella* Horv., 7, 13, 15, 19, 111-113, 131, 146.
- key to the species of, 147.
- macreta* Horv., 7, 146, 147, 149, 150.
- malkini* Slat., 7, 147-149.
- sabulicola* Bergr., 147-149.
- Stenosemia, 162.
- dimorpha* Copel., 161.
- Sterculia cuneata* Br., 286.
- Sterculiaceæ, 286, 293.
- Streblus asper* Lour., 295.
- Strombosia philippinensis* (Bail.) Rolfe, 281.
- Suckling, blood, 270; brain, 271; heart, 271; kidney, 269; large intestines, 270; liver, 269; lungs, 269; small intestines, 270; spleen, 270; stomach, 271.
- Suha, 284, 295.
- Sugar cane, 345; juice, 357, crude, 357; 2nd, 3rd, 4th class, 357.
- Sun-flower, 291.
- Sutanghon, 344; luto, 355.
- Sycorax, 205.
- japonicus* Tok. et Ets., 206.

Syzygium cumini (Linn.) Skeels, 288, 292, 360.
jambos (Linn.) Alston, 288.
samarangense Linn., 288.

T

- Tabaan, 285, 295.
 Tabacotabacohan, 294.
 Tabako, 289.
 Tabakotabakohan, 296.
 Tabatib, 280.
Tabernaemontana pandacqui Poir., 288.
 Tadyang kalabao, 290.
 Talahib, 279.
 Talanuk, 289.
 Tamarind, 348, 360; tops, 359.
Tamarindus indica Linn., 292, 359, 360.
 Tamayuan, 281.
 Tampoi, 288.
 Tan-ag, 286.
 Tanglad, 279.
 Tapilak, 290, 327.
 Tayum, 283, 295.
 Teak, 289, 296.
Tectona grandis (Linn.) F., 289, 296.
Telmatoscopus Eat., 205.
 advenus Eat., 213.
 albipunctatus Willi., 206, 213.
 ambiguus Eat., 210.
 autumnalis Bank, 211.
 britteni Ton., 210.
 caliginosus Eat., 217.
 frondeus Tok., et Ets., 206, 212.
 indicus Feuerb., 211.
 kii Tok. et Ets., 206, 210.
 negrescens Tok. et Ets., 206, 215., 216.
 saxiculus Tok. et Ets., 206, 208, 209, 211.
 snowhilli Rosa., 220.
 spinitibialis Tok. et Ets., 206, 217, 219.
Theobroma cacao Linn., 286.
Teracriini Stål, key to the genera of the tribe, 112.
Teracriini Stål, 7, 15, 19, 111.
Teracrius Bred., 131.
Teracrius Hesse, 131.
Teracrius Leth. and Sev., 131.
Teracrius Stål, 7, 13, 111, 112, 121, 131, 150.
 bipunctatus Bergr., 134, 135.
 burmanus Bred., 122, 123.
 burmanus var. *singalensis* Bred., 123.
 modiglianii Bred., 134.
 namaquensis Leth. and Sev., 132.
 namaquensis Stål, 7, 17, 129, 131, 132.
Tetrastigma harmandi Planch., 286.
Thespesia populnea Sol., 286.
Thymelaceaceæ, 287, 293.
 Tibig, 281.
 Tiesa, 288.
 Tikas, 280.
 Tiliaceæ, 286, 296.
Tinospora reticulata Miers., 282.
 TOKUNAGA, MASAOKI, and ETSUKO KOMYO. Japanese Psychodidæ, III.
 New or little-known moth flies, with descriptions of ten new species, 205.
Trema orientalis Linn., 281.
Trichomyia Hal., 205, 208.
 itocœe Tok. et Ets., 206, 207, 228.
 swinhoi Cock., 205.
Trichomyiinae, 206.
Trichopsychoda, 205.
 lepida Tok. et Ets., 206.
 shogakii Tok. et Ets., 206.
Triplaris cumingiana Fisch. & Mey., 281.
Truimfetta bartramia Linn., 286.
Tsiko-mamey, 351, 361.
Tubang kabayo, 291.
Tubang-usa, 280.
 Tubli, 283.
 Tubo, 279, 294, 345; katas, 357.
 Tukod-laŋgit, 348, 359.
 Turkey, 263, 265, 268; gizzard, 269; liver, 269.
 Turpeth root, 359.
Typhonium divaricatum (Linn.) Decne., 280.

U

Ualis-haba, 286.
 Uas, 286.
 Ubi, 280, 295.
 Ubod, 360; ng niyog, 349.
 UHMANN, ERICH. Gonophorini, besonders von den Philippinen, 229.
Ulasiman-bato, 281.
Ulmaceæ, 281, 292.
Umbelliferæ, 288, 293.
 Unpolished rice, raw, 355.
 UNRUH, M. Philippinische Leucosyke-Arten aus dem Philippine National Herbarium, 167.
 Urai, 282.
Urena lobata Linn., 286.
Urticaceæ, 281, 292.
Uttaris Leth. and Sev., 108.
Uttaris Stål, 7, 12, 13, 19, 20, 108, 109.
 pallidipennis Leth. and Sev., 109.
 pallidipennis (Stål), 7, 109.
 pallidipennis Stål, 109.

V

VALENCIA, VICENTA V., see MASILU-NGAN, MARAÑON, VALENCIA, DIOKNO, and DE LEON.
 Vanilla, 281.
 planifolia Ait. apud Naves novis, 280.
Verbenaceæ, 289, 293, 294, 297.
Vermicelli, 344, 355.
Vernonia patula (Dry) Nurr., 291.
Viola odorata Linn., 287.
Violaceæ, 287, 293.
 Violeta, 287.
Vitaceæ, 286, 293.
Vitex parviflora Juss., 289.
 trifolia, 289.
Vitis vinifera Linn., 286.

W

- Wagwag, rice, raw, 355.
 Waliswalisan, 286.
 Wallaceana Mlk., 230, 233.
 biseriata Uh., 235.
 Wallaceodendron celebicum Koord., 284.
 Wallacispa Uh., 230, 233, 235.
 Wandering jew, 280.
 Water lily, 282; poppy, 282.
 Watercrees, 348, 359.
 Watermelon seeds, 346, 358.
 Wikstroemia ovata Mey., 287.

X

- Xiphopteris, 382.
 Xyridaceæ, 365.
 Xyris, 366, 367, 375.
 adusta Koy., 365.
 capensis Thunb. var. Schoenoides
 (Mart.) Nils., 366.

- capensis Thunb. var. schoenoides Van
 Roy., 366.
 capito Han., 367.
 capito Mal., 367.
 complanata Brown, 366.
 complanata Van Roy., 366.
 indica Linn., 367.
 indica Mal., 367.
 indica Sm., 367.
 indica Van Roy., 367.
 martima Koy., 367.

Z

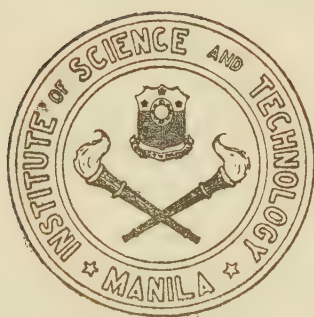
- Zapote, 341, 361.
 Zebrina pendula Schinzl., 280.
 Zingiber zerumbet (Linn.) Sm., 280.
 Zingiberaceæ, 280, 292.
 Zinnias, 291.

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CONTENTS

No. 1, March, 1955

[Issued July 9, 1953]

	Page
SLATER, JAMES A. A revision of the subfamily Pachygronthinae of the World (Hemiptera: Lygaeidae)	1
Four plates and five text figures.	

No. 2, June, 1955

[Issued December 27, 1956]

COPELAND, EDWIN B. New Philippine ferns, XI	161
Two plates.	
UNRUH, M. Philippinische <i>Leucosyke</i> -Arten aus dem Philippine National Herbarium	167
FELIZARDO, M. I. The making of Solar industrial salt in the Philip- pines	177
REYES, ARTURO C., and CARL LAMANNA. Snakebite mortality in the Philippines	189
LEVITON, ALAN E. Systematic notes on the Asian snake <i>Lycodon</i> <i>subcinctus</i>	195
TOKUNAGA, MASAOKI, and ETSUKO KOMYO. Japanese Psychodidae, III. New or little-known moth flies, with descriptions of ten new species	205
Fifty-two text figures.	
UHMANN, ERICH. Gonophorini, besonders von den Philippinen.....	229
Five text figures.	
RODA, A. P. DE, F. SABILLO, and G. D. ARCAINA. Shigellosis I. An analysis of 445 cases of shigellosis	253
One text figure.	
INTENAN, CARMEN LL., LEON G. ALEJO, VELONA A. CORPUS, ROSITA D. SALUD, ISABEL DEL ROSARIO, ROSARIO GOMEZ, JESUSA HENSON, and ISABEL CONCEPCION. Composition of Philippine foods, III....	263
Two text figures.	

No. 3, September, 1955

[Issued March 21, 1956]

MASILUÑGAN, VICTORIA A., JOAQUIN MARAÑON, VICENTA V. VALEN- CIA, NATIVIDAD C. DIOKNO, and PACIENCIA DE LEON. Screening of Philippine higher plants for antibacterial substances	275
Two plates.	
CANCHELA, GUILLERMINA V., and AURELIO O. CRUZ. Dehydration of castor oil for paints and allied products using local dehydrating materials	303
DEAN, JAMES, and GLADYS DEAN. The phonemes of Bilaan	311
One text figure.	

	Page
RAHMANN, RUDOLF, S.V.D., and MARCELINO N. MACEDA. Bow and arrow of the Visayan Negritos	323
Six plates.	
DOMANTAY, JOSÉ S. Rectification of <i>Oscarella malabonensis</i> , a spongiomorphic mass formed by myriad of tiny animals, mostly tube-dwelling amphipods, polychaetes and turbellarians	335
One plate.	
INTENGAN, CARMEN LL., ISABEL CONCEPCION, LEON G. ALEJO, VELONA A. CORPUS, ROSITA D. SALUD, ISABEL DEL ROSARIO, ROSARIO GOMEZ, and JESUSA HENSON	343
KOYAMA, TETSUO. The order Xyridales of Dr. Hayata's Indo-Chinese collection	365
Six plates.	
BOOKS	379

No. 4, December, 1955

[Issued June 14, 1956]

COPELAND, EDWIN B. Ctenopteris in America	381
Sixteen plates.	
ERRATA	475
INDEX	477

CONTENTS

	Page
COPELAND, EDWIN B. Ctenopteris in America	381
ERRATA	475
INDEX	477